For the Convenience of the Customer—Milo R. Maltbie on "Valuation" and other articles dealing with managerial topics.

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Electrical World

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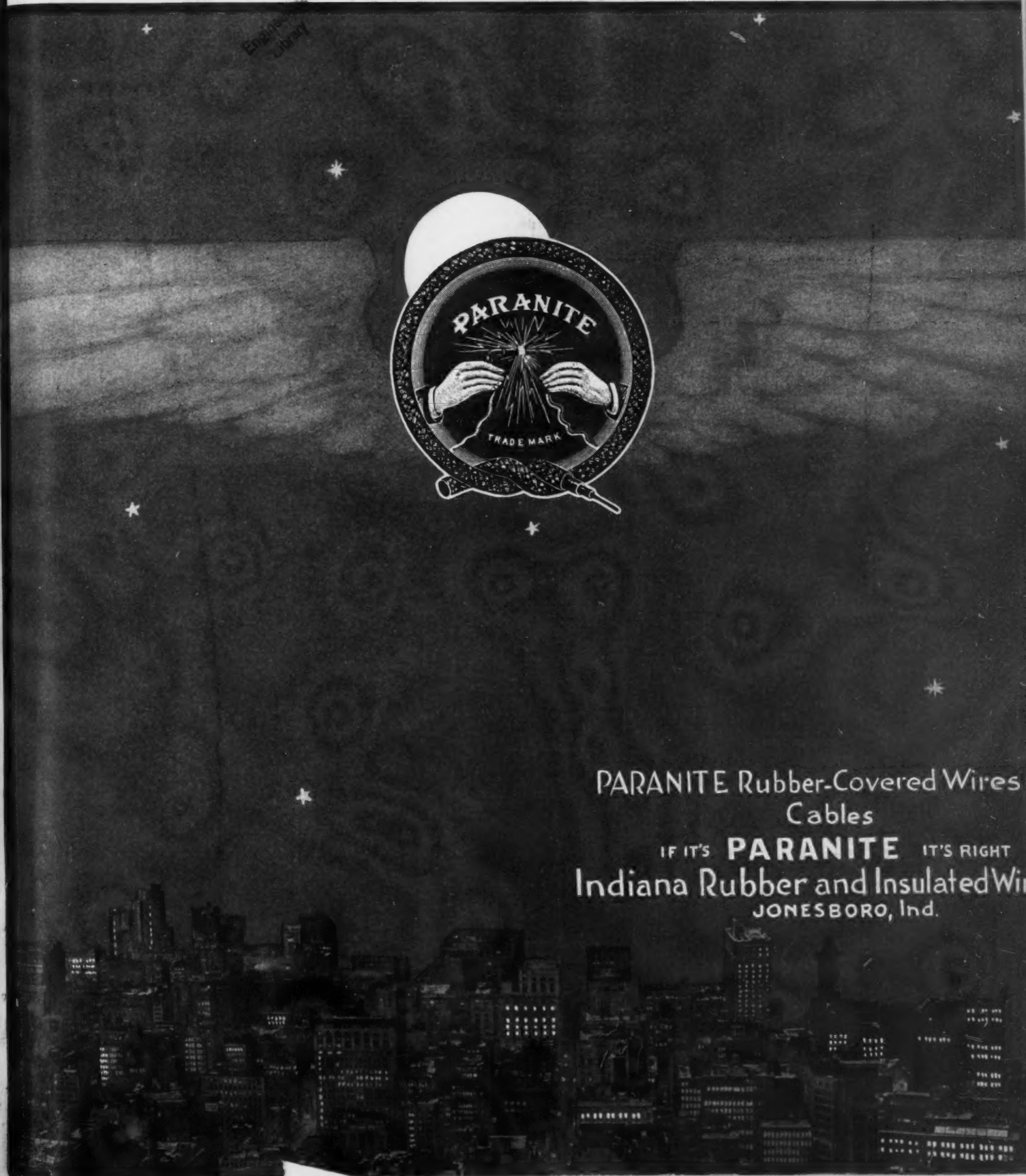


Weston

The Interesting History of Weston Instrument Transformers

A very serious problem confronted the Weston Company a few years ago, at the time it had perfected its now world-famous group of A. C. Switchboard Indicating Instruments.

The Company had developed these Instruments to the highest state of perfection, but unfortunately there were on the market no Transformers of sufficient accuracy and serviceability to use in combination with them. Exhaustive tests were made on all types of Transformers available in this market, and the Weston branches and representatives in foreign lands were commissioned to scour the field and send samples of the best Transformers procurable.

Not one of the Transformers thus obtained in this country or abroad even approximately met the requirements.

The Weston Company did not want to make Transformers, because of other work it deemed of greater importance; but failing to find Transformers that it could recommend to be used in conjunction with Weston Instruments with assurance of accuracy better than 1 per cent for the combination, it endeavored to have them built to special designs. Even then the results were far from satisfactory.

Realizing finally that the problem of Instrument Transformers was one that must be solved as other Weston problems had been solved, the Weston Engineering Staff thoroughly analyzed the subject and completed designs for various groups of Portable and Switchboard types of Current and Potential Transformers of a degree of accuracy and serviceability that completely met the practical requirements of switchboard practice and precision determinations in the laboratory.

These Weston Transformers established a new standard for Instrument Transformer design and construction.

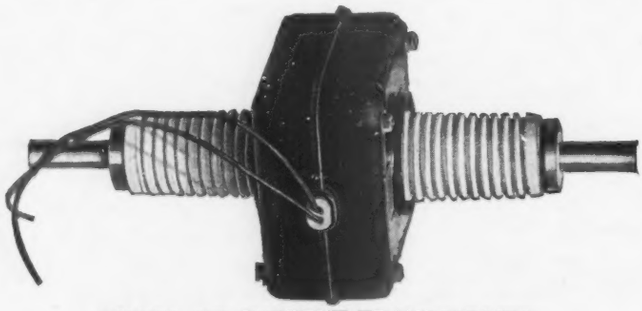
As might have been prophesied, the improvements made by the Weston Company resulted in improvements on the part of other instrument manufacturers, and this is one more instance of apparatus remaining stationary, so far as merit was concerned, until a Weston type blazed the way for betterments. The significance of this is apparent.

Model 312

PORTABLE INSTRUMENT TRANSFORMER

Weston Switchboard Instrument Transformers described in Bulletin 1501.

Weston Portable Instrument Transformers described in Bulletin 2001.



MODEL 365 CURRENT TRANSFORMER
For Use on 13,200 Volt Circuits.

Home Office and Factory
13 Weston Ave., Newark, N.J.

New York	Chicago
Boston	Detroit
Philadelphia	Toronto
Buffalo	Montreal
Richmond	Winnipeg
Cincinnati	Vancouver
Cleveland	Berlin
Pittsburg	London
St. Louis	Florence
Denver	Paris
San Francisco	Petrograd

Johannesburg, S. Africa

Weston Electrical Instrument Co.

Electrical World

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Excessive Valuations

DR. MALTBIE in an interview in this issue clothes in the language of diplomacy a serious accusation when he says: "The layman finds it difficult to understand how an engineer can say that a certain property has a value of $25,000,000, and another engineer finds the fair value of the same property to be $50,000,000, and perhaps another engineer gives in his testimony a value of $70,000,000." Speaking as he must from his experience as a public service commissioner, this assertion, general though it be, calls for some attention on the part of the professional engineering societies. If competent engineers can honestly differ so widely in valuing property, then there must be something rotten in engineering; and if it is necessary to boost valuations unduly so as to assure a fair value in the final compromise, then there is something rotten with regulation. Such a situation is untenable. It is unfair to the public and to the utility, and should be remedied. Certainly it will bear investigation.

Get the Public's Friendship

IN times gone by—fortunately long gone by—both the public and the utility companies took it as a matter of course that between them there should be deep and lasting hostility. For was not the public seeking to get everything it could out of the utilities? And were not the companies trying to do as little as they had to do for the public? With the argument running along these lines it is not strange that conditions arose which made necessary a new order of things. The era of regulation has brought about a better understanding on the part of each interest of the fundamental just rights of the other interest. Corporations know that they cannot afford to have the impression abroad that they are out to get as much as possible and to give up only what can be forced out of them. Public representatives have certainly learned that, unless the utilities are permitted to earn a good living for their capital investment, they cannot provide the service that consumers want and are entitled to have. Here and there we find an encouraging sign that the public has gone a step farther in its acquirement of an understanding in regard to the real position of the utility. One of the most striking of these indications is reported elsewhere in this issue.

That the public spoke up on behalf of the central station company in Lewiston, Idaho, is clear proof that it can be induced to do so elsewhere. It is a fact, of course, that the management in this case must have wisely given its energies in the past to the development of an attitude and a service that the public liked. It could not have disregarded public sentiment until the eleventh hour, and then come begging and had any success in obtaining support. What a number of people did for the protection of the company they did spontaneously. They accomplished for the company voluntarily far more than it could have done for itself without long contest and bitter feeling. They gave it the protection which it was fairly entitled to have, but which it was not getting and did not receive until the City Council had been told that it was making an unwarranted attack. It is a lesson to be spread broadcast.

Baltimore and Utilities

THE centennial of the introduction of gas into Baltimore has just been appropriately celebrated. That city saw the first American gas company, which was the second in the world. The period 1816-1916 has been crowded with momentous events and developments, but none can be regarded as more closely associated with human advance and welfare than the illuminating arts and inventions and the public utilities that have sprung from them. It is certainly agreeable and tenable that without the public utility corporation our cities would be without their supply of light, heat, power and transportation, for even the most rabid advocate of municipal ownership must admit that it was private enterprise and capital which "put them on the map" of modern life.

We are fortunate in being able to give in this issue from the present head of the Baltimore gas system a review of public utility evolution since June, 1806, and a remarkable succinct statement of the existing conditions under which and up to which the public utilities have come in the hundred years of marvelous and unsurpassed growth. Mr. Wagner's comprehensive article is most valuable in summarizing these conditions as well as those by which the utility can best discharge its mission as a public servant. There is a further value to this admirable discussion of the subject in the fact that it is so clear an exposition of the principles that govern, and of the high ideals with which the progressive managers of these great properties and agencies confront and execute their duties. The broad acceptance of the modern theory of regulation has never been more clearly acknowledged, and in this respect it should of course be noted that just as his article appears, Mr. Wagner takes up his new work as president of the National Electric Light Association, for which therefore in a sense he here speaks and whose spirit and aims he embodies. The association was foremost in its recognition of the public service commission as a means of

insuring to the public adequate service at fair rates, and in securing to the investor his reasonable reward, besides giving him an invitation to devote more and more of his savings to public well-being. The reference is made to it here as being symptomatic of the constructive work and the broad views illustrated by Mr. Wagner as a typical leader in the central station field.

Unreliability of Water-Power Report

WITH more details at hand we are enabled in this issue to present the first part of an analysis of the special report submitted to the Senate by the Secretary of Agriculture on the water-power situation in the United States. Close examination reveals an amazing lack of co-ordination, errors of fact, errors of engineering judgment and an entirely distorted presentation. The incomplete and sometimes unreliable data gathered by the Forest Service do not warrant the summaries and conclusions reached by its chief engineer, Mr. Merrill. That a report compiled at so great an expense by the government should be so full of inaccuracies as to render it useless is, to say the least, an imposition on the public.

Owing to the lack of engineering knowledge displayed in many of the deductions, engineers will give it scant consideration. A knowledge of practical operating conditions would never have led to the charge of over-development in the State of California, for instance, just because the sum of the individual peak loads of the independent systems did not approach the aggregate rated capacity of installation. This accounts for the inability of engineers to reconcile their knowledge of facts with that presented in the table showing the eighty-seven corporations which control not less than 30,000 hp. of primary power. The Niagara Falls Power Company, for example, is credited with a hydroelectric installation of 115,000 hp. This is true if it relates to the aggregate rated output capacity of the generating units in the plants at Niagara Falls. But the government ought to know that by a ruling of the War Department the Niagara Falls Power Company can only take water from the Niagara River equivalent to approximately 88,000 hp. This is not conjecture but is a matter of public record. This same method of inflation prevails throughout the report. The chief engineer of the Forest Service has merely taken the normal installed capacity in turbines regardless of the amount of turbine capacity which can be utilized or which has to be maintained as spare equipment against breakdown, or from which the power may not be available for various reasons. The hydroelectric station on the Susquehanna River at Holtwood is rated at 118,000 hp., yet that station at times has been just able to eke out 12,000 kw. during low-water periods. It is difficult to understand the motive which prompted the making of such a report unless it is the intention of the government to hamper honest and needful water-power development. That is not the function of government. If it cannot aid, it ought not to destroy that which can justify its existence.

The Importance of Applied Science

IN a purely agricultural stage of sociological development, in which each and every family works on its own farm for food and manufactures its own homespun, there can be but little opportunity for scientific application, because there are so many things for each individual to do that his efficiency in any particular piece of work must be very low. Such a state of society is stable, as history points out in many of her chapters, but it is stagnant so far as concerns development. It is the stage to which society always tends to revert after any industrial cataclysm.

As soon as any considerable portion of the community leaves the soil to enter factories, a corresponding industrial development commences. The processes of manufacture become specialized and, in the hands of experts, become susceptible of great improvements in effectiveness and in economy. Here invention and scientific applications reveal their wealth-producing powers. Industries fostered by great intelligence, good fortune and hard work soon acquire a widespread reputation and develop trade. After a time it becomes a contest of brains and energy, aided by science and art, as to which among a group of competing industries shall survive. The tendency is necessarily toward large aggregations of capital, intelligence and operative skill, where the applications of science and art are most powerfully employed.

Finally, when a majority of the people abandon the soil to a minority just sufficient to produce the required crops, the necessity becomes paramount for large and powerful organized industries, fortified with all the ammunition of trained expert intelligence, thrift, management, applied science and foresight. Only by the most earnest effort in all these directions can the industrial population command all the markets that are necessary for their production, and likewise for their food.

America, after having passed through an initial period of agricultural pioneers and settlers, and an intermediate period of home-production industrialism, is rapidly becoming an essentially industrial nation. Under such conditions large businesses will need to be fostered by Congress and not destroyed if the industrial worker shall sell his labor. Highly organized, but regulated, large industries will have to be managed with the highest skill and intelligence, and manned by healthy, earnest and loyal operatives. Only such organizations can ultimately win in the open competition for the world's markets. In such large industries trained specialists must work out the perpetual problems of economic production on scientific lines and by scientific methods. The day of the rule-of-thumb methods has gone, and every process must show cause why it should continue to exist.

Every scientific laboratory in the country is thus in demand for supporting the nation's needs. There is work for all, and it is sufficient that each should do the work for which it is best equipped. Moses was trained in all the knowledge of the Egyptians, and aspired to know everything. As late as Queen Elizabeth's day one

man—Lord Bacon—claimed all knowledge as his province, but he seems to have been the last pretender to omniscience. Nowadays, one man can only know well one specialty. The specializing of our engineering laboratories is therefore a process vitally important to their success, and to each such technical laboratory should be directed the particular industrial questions that it is specially prepared to investigate.

The opening of the new Massachusetts Institute of Technology, with its large technical laboratories, offers a fine opportunity for technical research in many directions that lead to industrial progress. The time should be near at hand when all of the engineering laboratories of the country should be associated in a definite cooperative movement, tending to give healthy development to each, and at the same time to give the best mutual aid to national industry.

Service That Underlies Sales

THAT the selling of electrical appliances carries with it a service has been many times emphasized. At the meeting of the electric range committee of the N.E.L.A. at Chicago several speakers pointed out the need of selling the range with a knowledge of how to use it. One phase of this service, the testing of appliances before they are put on the market by the local distributor was discussed by Mr. Cozzens in the last issue. Mr. Cozzens outlined a method of testing that has proved valuable, and which should be read not only for the specific suggestions it contains, but for the questions of sales policy which it advances.

When a company undertakes to build up its appliance load it is certainly sound and wise policy to have everything which it sells thoroughly tested to see that it is safe, that it is durable, that its costs of operation are not excessive, and that it is generally suitable and convenient for the uses intended. The details of these tests as given indicate that by one large company at least they are made in a thorough and scientific fashion. Electrical heating and cooking appliances certainly require economy and durability tests in order that their use may be made advantageous to the consumer. In many motor-driven household equipments the same data are imperative, and the central station that encourages, for example, the use of vacuum cleaners on its system ought to be able to tell from personal knowledge how their use will work out in consumption of power and whether the equipment is going to be adequate to the probable needs of the consumer.

There is a strong and regrettable tendency to judge the efficiency of a salesman merely by the gross amount of the business which he is able to show as a result of his week's work. This may be an adequate test of salesmanship for a man who is selling soap in a territory which he knows he is unlikely to revisit. It is not a sound test for the sale of electrical energy, which is practically delivered with a perpetual guarantee of good service. Every customer taken on by a central station is a liability as well as an asset. His complaint cannot be ignored if the goods received are not as represented. Further, careless or ignorant selling cannot be remedied by the labors of the complaint department, the necessity for whose activities is no more creditable to the company than an abnormal record of accident cases would be. Hence the need of a precise knowledge of the goods sold on the part of the salesman, fullness of knowledge in representations concerning them, and good judgment in recognizing the boundaries of the field.

Rating Lamps in Lumens

AT the last meeting of the N.E.L.A. the question of rating lamps in lumens was again seriously discussed. This subject has been up repeatedly, and has in general had favorable consideration without any results thereafter following. In a similar way mean spherical candle-power has repeatedly been considered as a substitute for the customary horizontal rating, has generally been highly recommended, and practically has never been used. As respects h.c.p. and m.s.c.p., the difficulty has been rather obvious that the rating of lamps by the latter method gives a lower numerical value to the candle-power than if reckoned by the former method, a 20-cp. lamp on horizontal rating being about a 15 or 16-cp. on spherical rating. From a commercial standpoint this has been objectionable. In a precisely analogous manner the metric system has suffered from the fact that its unit of length was a long yard instead of a short yard, and the unit of capacity a big one instead of a little one. Had the meter been 33 in. and the liter about nine-tenths of a quart it is highly probable that both would be in regular use. The rating of incandescent lamps in lumens is a different matter, and numerically the rating is unobjectionable except as it may seem so far from the customary one as to require an explanation. The main trouble is that the ordinary person does not know a lumen from a Croton bug. The idea behind the lumen is a rather mathematical one involving the intrusion of the ubiquitous π, and it is not easy to explain to the man on the street. The rating of lamps in lumens should be preceded and followed by a vigorous campaign in education, but it has very much to recommend it, particularly in these days of gas-filled lamps. It is no joke to obtain a reliable horizontal rating for a gas-filled lamp. The distribution of light in azimuth is sometimes very erratic, and that in elevation equally so. In fact, the photometry of the gas-filled lamp is a rather troublesome proceeding, particularly when it becomes necessary, as in the practice of some large illuminating companies, to make rapid commercial tests. The total luminous flux, however, is very readily measured in a sphere photometer, and can then be as handily expressed in lumens as in any other way. More and more illuminating engineers are coming to use the flux method in their computations, and a straight commercial rating in lumens would certainly be a convenience. Such a rating ought to be pushed into use, and the chief question is how this can be done in the most effective way. The difficulties are considerable. If the change is to be made, a period of popular explanation is a necessary prerequisite.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

THIRTY-THIRD ANNUAL MEETING OF THE A.I.E.E.

General Features of the Convention Sessions Held in Cleveland, Ohio, This Week

When the thirty-third annual convention of the American Institute of Electrical Engineers, which was still in session at Cleveland, Ohio, as this issue of the ELECTRICAL WORLD goes to press, was called to order on Tuesday morning, about 250 members were present. The Institute headquarters were at the Hotel Hollenden, where arrangements were also made for holding all technical sessions except those scheduled for Friday. The papers announced for this session were scheduled for presentation on board the steamer City of Erie during an all-day excursion. The seventeen papers which the program called for were arranged in five subject groups and delivered at as many sessions. The industrial power papers were presented on Tuesday morning, those devoted to power transmission on Tuesday afternoon, and those taking up protective apparatus on Wednesday morning, while Thursday morning was devoted to electrophysics and Friday morning to special technical sessions. This arrangement of the serious convention work made it possible for all members to take advantage of the special entertainment features planned for each afternoon by the local Institute committees.

PRESIDENT CARTY'S ADDRESS

The convention was formally opened on Tuesday morning by fitting remarks of welcome by a representative of the Mayor of Cleveland. President J. J. Carty then read, according to custom, the annual presidential address, choosing as his subject "The Relation of Pure Science to Industrial Research." His remarks on this subject were particularly timely and appropriate. He showed that arising out of the stupendous upheaval of the European war, with its startling agencies of destruction, comes a growing appreciation of the importance of industrial research, not only as an aid to military defense, but as an essential factor in the development of every industry in time of peace. He said that while many concerns in America have now well-organized industrial research laboratories, particularly those engaged in metallurgy and dependent upon chemical processes, the manufacturers of our country as a whole have not yet learned of the benefits of industrial research and how to avail themselves of it.

"I consider that it is the high duty of our Institute and every member composing it, and that a similar duty rests upon all other engineering and scientific bodies in America," said Mr. Carty, "to impress upon the manufacturers of the United States the wonderful possibilities of economies in their processes and improvements in their products which are opened up by the discoveries of science." The way to realize these possibilities is through the medium of industrial research conducted in accordance with scientific principles.

"Once it is made clear to our manufacturers that industrial research pays," he continued, "they will be sure to call to their aid men of scientific training to investigate their technical problems and to improve their processes. Those who are first to avail themselves of the benefits of industrial research will obtain such a great lead over their competitors that we are warranted in looking forward to the time when the advantages of industrial research will be recognized by all."

Mr. Carty pointed out further that the benefits of industrial research are not alone to be enjoyed by the large concerns if the matter is properly handled. By co-operation among themselves in establishing new laboratories or through the service of existing industrial research laboratories the small companies can realize the benefits of the largest companies.

INDUSTRIAL AND SCIENTIFIC RESEARCH DISTINCTION

In distinguishing between industrial research and purely scientific research, President Carty pointed out that confusion arises in trying to consider the subject matter of two classes of research, whereas the real distinction is to be found in the motive of the research and not in the subject matter. He likened the investigator in pure science to the explorer of new lands, and the investigator in industrial research to the pioneer who surveys the newly-discovered territory to locate its resources and in other ways prepares for the peaceful and profitable occupation of the new territory.

"Industrial research," he pointed out, "supports itself or it fails of its purpose, and, therefore, it will not lack for generous encouragement and support. Scientific research, on the other hand, must have encouragement and financial support."

The university, which the speaker believes is the proper home of scientific research, should find a way to encourage to the utmost the conduct of pure scientific research as a great responsibility which rests upon it. When a university develops a master scientist he should be provided with all the resources and facilities that he can employ that the range of his genius may not be restricted. This assistance the speaker believes will be forthcoming from public-spirited citizens and industries alike, with the realization that there will eventually be a just and adequate return.

DEVELOPMENT OF BRITISH STANDARDS OUTLINED

Following President Carty, C. le Maistre, general secretary of the International Electrotechnical Commission, read a brief paper, in which he outlined the development of engineering standards in Great Britain, and showed how order and system are essential to modern production. The need of international standards and the work of the International Electrotechnical Commission were touched upon. He illustrated by referring to temperature limitations in the ratings of machines, and the advisability of some agreement in nomenclature and symbols for interpreting specifications and bids offered by one country to another. Mr. le Maistre paid a word of tribute to Drs. A. E. Kennelly and C. O. Mailloux for assistance in the work of the International Electrotechnical Commission.

The discussion brought out the details of the organization of the British Standards Committee which was outlined diagrammatically on page 1460 of the June 24 issue of the ELECTRICAL WORLD. In Great Britain the different engineering and scientific bodies have united and are successfully co-operating in the establishment of standards for the different industries. Dr. C. H. Sharp and Dr. C. P. Steinmetz, members of the Inter-

national Electrotechnical Commission and Farley Osgood as member of the A. I. E. E. Standards Committee complimented Mr. LeMaistre on the results of his personal and official activity in promoting standardization.

STEEL MILL ELECTRIFICATION

The essential requirements of electrical operation in steel mills, with special reference to reversing mill drive, took up the greater part of the Tuesday morning session devoted to industrial power topics. David Hall abstracted the paper on "Electric Drive for Reversing Rolling Mills," by Wilfred Sykes and himself, in which the present status of the electric drive, both as to economy of operation and electrical characteristics suited for the work, were pointed out. The great progress of the past few years was emphasized as an indication of the importance of the work, and reference made to the advance in design and installation in each new plant constructed. In less than a year it was said that there will be in operation in Chicago a steel mill which will represent the most advanced practice in all details of any plant yet built. In the discussion on the paper it developed that there is yet a difference of opinion on the basis of rating steel mill motors, whether by horsepower or by torque. The point was brought up that in the latter case it is essential to give the time during which the maximum load is carried. Mechanical problems were also mentioned as important considerations in securing satisfactory drives, involving flexibility of layout, suitable bearing design and the like. To reach the last hair of efficiency is not so important as to secure high reliability. Differences in speeds in this country and abroad were brought out, the speeds in this country in some cases being not more than half as high as those in Europe. The problems of oil-well drilling, pumping and cleaning were taken up in the second paper.

SYMPOSIUM ON GROUNDING NEUTRAL

The symposium on grounding the neutral on high-tension transmission lines, which presented the experiences of some thirteen companies in different parts of the country, called forth the usual lively discussion that this subject elicits when brought before the Institute. As in previous instances there were those in favor and against it, and those who could see no difference in operating results with the neutral grounded and without on the same system. It developed that the grounding of systems is a matter which depends largely upon engineering conditions peculiar to a system, and favoring the practice as the voltage increases or approaches 100,000. David B. Rushmore contributed one of the most pointed remarks of the discussion by showing that the economics of any situation are the controlling factor. For present high-voltage systems he said that the severe demands for uninterrupted service have made it seem advisable to use proper means for isolating line disturbances, and that the grounded neutral with protective relays to operate automatic switches is one method of meeting the situation. Considerable discussion was also brought out by the explanation of the selective relay system for opening the field circuit of generators for short intervals of time, when short-circuits occur in the system as a practice to prevent interruptions in service by allowing the circuit to clear itself.

Further and more extensive details of the points brought up in the papers and discussions will be presented in next week's issue.

PROTECTIVE APPARATUS

The session on Wednesday morning was devoted to a review of the work of the Institute protective apparatus committee, the papers being written with one exception by members of this committee. The details of methods to protect transformers on the distribution system of the Commonwealth Edison Company, as outlined in a paper by D. W. Roper, were considered to be a valuable engineering contribution and a practical solution of the problems involved. The remaining papers of this session were progress reports covering different phases of the committee's work. Prof. E. E. F. Creighton, chairman of the protective apparatus committee, modestly stated in opening the session that contrary to precedent the members of the committee this year had done most of the work. The papers presented were selected, it was pointed out, as a balanced group covering the committee's work, but did not represent work done by several other members. He mentioned particularly a paper by E. P. Peck, and stated that arrangements had been made to present this to the industry through another source. A summary of Mr. Peck's investigations which cover methods of protecting telephone apparatus on circuits run on the towers carrying power conductors will be presented in an early issue of the ELECTRICAL WORLD. Dr. C. P. Steinmetz and other speakers, in commenting on the group of papers presented at the Wednesday morning session, called attention to the fact that the cost of 100 per cent protection to apparatus represents more than the actual saving brought about; but is important and advisable, due to the value of uninterrupted service. However, it was also emphasized by P. Junkersfield and others that local conditions govern the extent of refinements that are justifiable in any case.

INTRODUCTION OF PRESIDENT-ELECT H. W. BUCK

Tuesday night the annual banquet was held at the Hollenden Hotel. Preceding the dinner a reception to members was held. In the receiving line were President Carty and Mrs. Carty, President-elect H. W. Buck, Charles F. Brush and Dr. E. P. Hyde. Following the dinner President Carty, in that genial way which has marked the conduct of his administration, presented the president-elect, H. W. Buck. Mr. Buck expressed his appreciation of the honor the Institute had accorded him. He compared the growth in the industry to one of his personal experiences, stating that he had installed in Cleveland two 800-kw. generators which were monsters in those early days, but which at present would be considered small in everything except the space they occupied. He pointed out the widening influence of the work of the electrical engineer, suggesting that power was a necessary factor in the development of practically every industry, and that electric power had now become the motive force. He called upon electrical engineers to realize their importance in the work of the world, and to take their place with the knowledge that their work was more widely recognized to-day than ever before.

ENTERTAINMENT FEATURES

The Cleveland convention committee is deserving of much credit for the working out of a varied and enjoyable entertainment program, which included a luncheon and sight-seeing trip on Tuesday afternoon for the ladies attending the convention and those of the local section, an automobile trip for all members and guests through the parks, boulevards and residence sections of Cleveland, a theater party for the ladies on Wednesday night and an afternoon outing at Nela Park, the site of the National Lamp Works of the General Electric Company, on Thursday afternoon. The annual ball game was played at this time and a bowling contest and golf tournament was held. Dinner was served in the Nela Park self-serve dining room at 6 p. m. on Thursday, after which the party took special cars to the Shaker Heights Country Club for the presentation of the past-president's badge. The Lake Erie boat trip on Friday was a unique feature.

TO BOOST ELECTRIC VEHICLES

Manufacturers, Dealers and Garage Men Adopt a Working Agreement with That in View

At an enthusiastic meeting of the Chicago Electric Vehicle section of the National Electric Light Association on June 27 important steps were taken toward constructive co-operation between manufacturers, dealers and garage men, and resolutions offering a reasonable, fair and logical working basis toward bringing about more satisfactory conditions to the manufacturers of electric vehicles, batteries, tires and the operators of electric garages engaged in the sale, equipment and care of electric vehicles in Chicago and vicinity, were proposed.

There were present a total of forty-seven, including sixteen garage men, eleven battery men and five car manufacturers. Of these nine garage men, five battery men and five car manufacturers subscribed their names at once to the resolutions after they had been fully discussed and passed by the section, and others will undoubtedly sign in the near future. The gist of the outline of policies passed on item by item and intended as expressing the sense of a working agreement, the exact details to be more carefully worked out later, follows:

Substance of Working Agreement

The garage men subscribe to a start in placing their business on a fundamentally sound basis by installing an adequate cost system through the medium of which they will be able to gain the proper knowledge of their business and its cost so that the necessary aid can be given by the Electric Vehicle Association.

Full consideration is to be given to placing the garage business on a paying basis in every department by revising the present flat rate or by substituting for it measured service throughout.

An adequate standard of service covering the most important service requirements of electric cars, batteries, etc., to be determined by a representative body of men comprising all interests concerned, is to be distributed in printed form and lived up to by all.

All association garages doing repair work of any nature are to co-operate closely with the dealers, to call on the dealers' service departments for assistance or advice when not entirely familiar with the piece of work, instead of taking a chance, and in general to use every means to keep all trouble pertaining to batteries and repairs between themselves and the dealer.

The electric garages are to use every means toward promotion of the sale and use of electric cars, and as a means to this end to report to the secretary of the association all leads or possible prospects so that their names can be distributed impartially to all dealers.

Dealers Subscribe to Plan

The dealers pledge their hearty recommendation of Electric Vehicle Association garages in preference to all others in advance, to all persons with whom they deal, similar recommendations to be made, if possible, to all electric car purchasers. The names of car purchasers are to be given to the secretary of the association in order that advance notice can be impartially distributed to all association garages. Notice is also to be mailed exploiting the Electric Vehicle's Association's parking system to all purchasers, letting them know the great value of this service and the fact that it can be obtained only through Electric Vehicle Association garages. All present owners of electric vehicles are to be notified by the respective dealers, recommending Electric Vehicle Association garage service, making it plain that the dealers are openly supporting these garages above all others and telling them why.

On repairs where batteries are sold on a guarantee basis, which guarantee can be issued by the garage operator, all adjustments on such guarantees are to be made to the owner based on the regular retail price of the battery, and such adjustment is to be allowed to be made by the garage man, battery manufacturer or dealer. Regular prices on batteries established by the battery manufacturer are not to be cut.

Where cushion or pneumatic tires are to be sold at regular retail price and only standard guarantees given these same guarantees will be used by garage men or dealers.

The dealer's inspection service will be continued and will be carried on not only as an aid to the promotion of the use of electric vehicles by keeping them in A1 running order, but as an assistance to the garages in raising their standard of service by giving notice to the garage first on any matters needing attention on the car not due to general wear, tear or accident. If the garage fails to honor this notice by correcting the trouble, the owner of the car will be notified.

On such repair work as is done by the public garages the dealers will agree to furnish expert advice at all times on the care and repairing of cars. Furthermore, if a garage requires the special services of an expert from the dealer on any case the dealer will agree to furnish such experienced repair men on that particular case to assist the garage man with the understanding that the garage man will pay a reasonable amount for the time consumed.

One Public Service Company's Campaign for Americanism

The Indiana & Michigan Electric Company of South Bend, Ind., during the last week in June sent out to its customers and friends 15,000 lapel flags and circulars like the one reproduced herewith. The purpose in distributing the flags at this particular time is well set forth in the statement of the president of the company, F. A. Bryan, who is a believer in advertising that gives his customers and prospective customers to understand that some corporations are not without souls. The flags pinned to the circulars were also sent out with bills for electric service, at a total cost of about 1.1 cents each.

INDIANA AND MICHIGAN ELECTRIC COMPANY
NOT since the close of the Civil War has there been so serious a crisis demanding that Americans should signify to the outside world as well as to "the strangers within our gates" that This is a Nation. Hence we all, regardless of party, class, origin, religion, prejudices or sympathies, should join in emphasizing and proclaiming this fact.
The Flag Symbolizes This National Unity; and Independance Day is sacred to Liberty and Union.
Therefore, Will You Not Wear This Flag until after July Fourth?
Millions of Americans are thus indicating their patriotism. Let us be among them.
F. A. Bryan
President

THE SENTIMENT AND LAPEL FLAG THAT WENT TO 15,000 CUSTOMERS AND FRIENDS OF THE SOUTH BEND COMPANY

Public Service and the Consumer

Efficacy of Regulation in Obtaining for the Public Adequate Service at Reasonable Rates and in Securing to Capital Its Just Reward

BY HERBERT A. WAGNER
President, National Electric Light Association
President, Consolidated Gas, Electric Light & Power Company of Baltimore

PUBLIC service in the United States passed its one hundredth anniversary on June 17 of this year. The American gas centenary was celebrated on that date in Baltimore, the home of the first gas company in this country and the second in the world. While gas has been served to the public by corporations for 100 years and electricity for lighting for more than thirty-five years, it is only within more recent times that this service has so reached and affected the public at large as to bring into general use the term "public service," as applied to such undertakings.

The remarkable extension in the use of both gas and electricity and the wonderful development of the electric industry during the last quarter of a century have brought about great changes in the status of the public service business.

It is well to consider the manner in which the industry has developed through many adverse conditions and to draw from this review some conclusions as to its future conduct and welfare.

HERBERT A. WAGNER,
President National Electric Light Association

INCEPTION OF LIGHTING COMPANIES

Far-seeing men of courage and ambition had realized that in the development and growth of city life the centralization of production and supply of many of the people's daily needs was a necessary economic evolution. The discovery of illuminating gas, and the development of processes for its production and distribution, at an early date attracted the attention of such men. All new enterprises have begun with the initiative and forethought of the individual. Later, the magnitude of many enterprises has required the organization of stock corporations.

The undertaking to supply a large city with gas, and later with electric service, required such a relatively immense amount of capital from its very inception, and ever thereafter for its continual growth, that such enterprises have, from the start, required the formation of large corporations. The question of municipal or governmental ownership of public utilities has been of very recent origin and could never have entered the minds of the people until long after the utilities in question had been developed on a large scale and were prominent entities, and, moreover, not until the great risk in capital always attending the development of new and untried undertakings had been eliminated by the untiring energy and determination of the individuals who took upon themselves the burden of the development and the early losses in capital.

Corporations are formed and business is undertaken with the anticipation of profit to the individuals uniting in the enterprise. Untried enterprises and undeveloped processes require the promise of unusual profit to induce investors to risk their capital in them. The gas business, and, to a still greater extent, the electric business, were, and to some degree still are, in this category. This was universally conceded in the early days of these industries, and quite generally accepted until very recent years. Nobody for one moment believed that anyone would invest in the stock of such corporations without the hope of large dividends at some time in the future. Few people believed that these new enterprises could show any profit until after years of experimental operation, and history has proved this to be true. But after years of hope deferred these gas and electric properties at last began to show profits, and to pay dividends. Then the man who had looked upon his neighbor as a fool to invest his money in such hazardous undertakings began to undergo a change of view. He now saw a profit being made and began to consider the source of the profit. The service was rendered to and paid for by the people. The people were, therefore, in his opinion paying the profit. Why should the people pay a profit on a public service of which they were the sole supporters? The memory of our neighbor's losses is soon forgotten in the envy of his final success. Such ideas are the basis of a demand for public ownership.

THE HAZARDS OF COMPETITION

Fortunately for their own welfare, the majority of the people in this country now believe in government regulation for public utilities, rather than the wasteful and inefficient alternative of government ownership. But, before the demand for government regulation came the era in which those who sought to deny their neighbor a profit in return for the risk of his capital, clamored for competition as a means of keeping down the price of the service.

Competing companies were promoted and organized. This only resulted in increasing the risk on capital in-

vested, in a duplication of investment for the same service, and lower prices only for a brief period until the inevitable consolidation of the competitors to save both from bankruptcy. As there was now more capital invested than would have been necessary with only one company, the price for service became and remained higher than would have been necessary had there been but one company. For any given return on capital competition must, of economic necessity, increase prices unless offset by some possible improvement in the methods of production.

While the gas business was still struggling with competition, and consolidation and deferred profits, a new competitor entered the field in the form of the electric light. The early struggles and disappointments in the gas business were then duplicated in the electrical field and increased by the competition between gas and electricity. The duplication of investment and inevitable consolidations continued. In these consolidations, together with improvements in apparatus and devices, much of the early property and tangible capital disappeared, through displacement, with no adequate profit to compensate for the loss.

But the public was slow to realize the wastefulness of this unlimited and recurring competition and consolidation, and competition was still held to be a necessary means for controlling rates. On the other hand from the corporation point of view, special privilege for private gain was still the ruling idea.

The public received scant consideration, and serving the public was only a means to an end.

Monopoly with Regulation

State control was attempted here and there but in a most ineffective way although as early as 1876 the principle which constitutes the cornerstone of the regulating statutes of this country was enunciated by the Supreme Court of the United States in a decision in which it was said that property becomes clothed with a public interest when used in a manner to make it of public consequence and affect the public at large, and consequently the public could control such property for the common good.

The change of thought which finally brought order out of this economic chaos and waste was the realization that public service should logically be a monopoly controlled by government regulation. This resulted in the institution of state public service commissions. These commissions have undertaken to regulate the rates charged by public utilities and, in turn, to protect the public and the utilities from the wasteful results of competition, when such is unnecessary to provide adequate service. In arriving at fair rates for service the commissions have sought to determine, as a basis, a fair rate of return on the capital invested in the service of the public. These investigations usually include a valuation of the public service company's property. The value of a company's existing physical property cannot possibly, however, equal the capital invested during a long period of years with the vicissitudes, consolidations and displacements which most public service companies have been forced to undergo. Liberal allowances must, therefore, be made for intangible property for which the meager earnings of the past have been insufficient to provide an amortization fund.

Of far more importance to the public than the lowest possible rates is adequate and satisfactory service. Service, to be satisfactory, must respond to all the consumer's reasonable needs. It must be dependable, sufficient in quantity and quality, and with means provided for keeping the consumer's equipment in repair for utilizing the service. To be adequate, this service should not only remain at the consumer's command where he is now located, but should follow him when he moves to a new location. Adequate service, therefore, must include the continual extension of service to all reasonable points to provide for the growing and shifting needs of the community.

Electric service means far more than the sale of a commodity. It means the ever-readiness to supply the consumer just when, where and as he needs it, be his immediate requirements little or great. Service of substantially this kind has become such a matter of fact with the consumer that it is a necessary adjunct of his every-day life, and he has come to depend upon the result of turning the electric switch, as firmly as he expects the daily rising and setting of the sun. It is a service which he could no longer do without. The maintenance of such service, however, not only requires ample earnings for operations, but a ready and continuous supply of new capital for the necessary extensions. Investors will not supply the new capital without the assurance of safety and profit. Rates for service that are too low, giving but a meager profit or return on investment, cannot possibly provide good and adequate service. The rates for service must provide a fair profit and a margin above that profit to insure at all times a steady and adequate return to the capital invested, or else capital will not be invested and the service cannot be extended. Capital must be attracted, interested and convinced. Capital must be treated fairly or it will not come back, and the term "capital" includes the small investor as well as the large one. The majority of stockholders in large corporations are, in fact, small investors.

Stability of Investment

The rate of return in interest or dividends on invested capital depends greatly upon the safety and stability of the investment. It may be 6 per cent on safe investments, and as high as 10 per cent on investments subject to risk. This is the law of business for business enterprises, and the public service business is just as firmly subject to this law as it is to the laws of the state.

Let each consumer of electricity ask himself this question: "Would I invest all of my savings in the stock of my local electric company to provide a sure

The National Electric Light Association

The strongest and most potent factor in developing and improving the character of electric service generally in this country has been the National Electric Light Association. Composed as it is of a membership which includes the leading companies and most advanced workers in the electric public service, it is laboring constantly not only for the scientific development of the art for the most economical production, distribution and utilization of electricity, but for the most effective co-operation with regulating commissions for securing and maintaining the fairest relations with the public. The National Electric Light Association stands for public service in the broadest, fullest and most comprehensive sense and its extension, perfection and lessened cost for the mutual and interdependent benefit of both the consumer and stockholder.

The many committees of the association provide for research and constructive development in every branch of the industry and the reports of these committees are advanced treatises and works for reference in the art.—H. A. Wagner.

income for my wife and children in case of my death? Would I be satisfied to have a substantial part of the funds and surplus of the insurance company in which my life is insured invested in such stocks?" If not, why not? Don't you consider it a perfectly safe investment? If you have doubts, why should not others have the same doubts? If everyone had such doubts, where would the company get the hundreds of thousands of dollars of new money each year to provide the ever-increasing demands of the public for service? The consumer must realize, after a little thought, that when he demands good and adequate service he must also demand that the company's securities, which it must sell each year to provide for the extension of this service, shall be a safe and profitable investment. It is to the consumers' vital interest to co-operate in assuring to the company a sufficient profit and stability to attract capital; not too much profit, but an ample and assured profit.

This is all the public service company wants, and it must be what the thinking consumer wants for his own protection. In this the interests of the consumer and the company are one. And the more definitely the profits of the company are assured and protected, and the more confidence there is induced in the minds of investors, the lower will be the rate of return the investors will demand. This will react to reduce the rates for service, and will, in the long run, provide the lowest rates possible by any means.

But the confidence of the investor is not easily obtained. He is not satisfied with to-day's profits. He demands a record of profits over a past term of years and the assurance of fair treatment of the property for years to come, if he is to be satisfied with the low rate of return provided by the safest investments. He bases his judgment, too, on the experience of those investors in the same company who have preceded him, rather than on the physical assets of the company.

FAIR TREATMENT OF INVESTORS

The new investor always considers the record of the rate of return on the market value of the company's securities, and the denial to the company of a fair return on that value, rather than on the value of its physical property, would be sufficient indication to him that he also might be denied a fair return on his investment.

The repudiation or depreciation of a company's capitalization is a sure way to render it incapable of financing its needs to provide good and adequate service, and incapable of adopting the lowest rates for such service. This same economic truth is strongly emphasized in a recent editorial in the Baltimore *News* of May 16, 1916, in reference to the Maryland Public Service Commission, which was in part as follows:

"Regulation of corporations by commission seems an old story to-day, though, as a matter of fact, it is in its infancy. Commissions cannot undo all the evil that has been done in the past in our haphazard treatment of public utilities without seriously interfering with their capacity to perform their functions properly. They must, in large measure, let bygones be bygones. Their chief purpose is to protect the public from injustice in the future, to hold corporations up to a high standard of service, to force them to do equity and at the same time to see to it that they are not made victims of impractical or unfair demands. If this work is to be done successfully, the commissions must enjoy public confidence first as to their integrity and next as to their fitness for their duties."

In any business lower prices for the product can be brought about only by better methods of production and management, and by increased volume of production and sales.

Some incentive is required to make such improvements appear desirable to the management and owners. This incentive is usually found in the hope of greater profit. The public service business needs this same incentive for improvements and expansion which make lower prices for service possible. If rates are continually being lowered, with no increase in profits, all incentive to adopt methods to lower operating expenses will naturally cease. Some division of excess profits between the consumers and the company is, therefore, essential to assure the best results for the consumer. This should take the form of a reasonable increase in dividend rate, following a reduction in the rates for service.

PARTNERSHIP OF UTILITY AND PUBLIC

Under wise public service commission regulation and supervision all that benefits the public service company reacts to benefit the consumer. Ample profits must result in constantly improved and extended service and lower rates. The consumers are dependent upon the public service company, and the company is dependent upon the consumers. The relations of the two should really constitute a partnership for mutual benefit. Their interests are not opposed, but are actually interdependent. Neither should seek to reach for all the benefits, for they would be of short duration. It is just as incumbent upon the consumer to be fair to the company as it is for the company to be fair to the consumer. Mutual confidence is essential to the best interests of both.

If every consumer were convinced that all other consumers would be fair to the public service company, and wanted to assure the company a fair and adequate profit at all times, every consumer would consider the stock of the company the safest investment for his savings, and all who could would become stockholders. All would thus share in the company's profits, and a truly mutual public service corporation, operated by the consumers for the consumers, would result.

Several public service companies in this country have effective working plans for interesting consumers in investing in their securities, and this effort if generally adopted would go far toward attaining that mutual confidence and dependence between the public service corporation and its consumers which alone can assure the highest efficiency and most nearly ideal results.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION

The strongest and most potent factor in developing and improving the character of electric service generally in this country has been the National Electric Light Association. Composed as it is of a membership which includes the leading companies and most advanced workers in the electric public service, it is laboring constantly not only for the scientific development of the art for the most economical production, distribution and utilization of electricity, but for the most effective co-operation with regulating commissions for securing and maintaining the fairest relations with the public. The National Electric Light Association stands for public service in the broadest, fullest and most comprehensive sense and its extension, perfection, and lessened cost for the mutual and interdependent benefit of both the consumer and stockholder.

The many committees of the association provide for research and constructive development in every branch of the industry and the reports of these committees are advanced treatises and works for reference in the art. The new administration hopes to carry on this great work for the association's new year with increasing benefit to its members and to bring about a greater realization of the mutuality of interest between its member companies and their consumers.

Analysis of Merrill Report on Water-Power—I

Investigation Shows the Document to Be Laden with Error, Its Conclusions Based Upon Defective and Deceptive Data and Its General Tone Misleading and Harmful

IN THE issues of the ELECTRICAL WORLD of Feb. 5 and Feb. 12, 1916, was published a rather full abstract of a special report submitted to the Senate on Jan. 20 by the Secretary of Agriculture. This report was submitted at the request of Congress and gave the results of an investigation of the water-power situation in the United States, made by the Forest Service during the last year. The report was presented in three parts: Part I containing the text of the report, Part II, the plates and tables concerning primary power, power generated and financial statistics, and Part III the data on the inter-relations of public service holding companies, and in turn the relations they bear to certain financial institutions.

The abstract appearing in these pages was taken from Part I, which summarized the conclusions. Parts II and III were not then available, and in fact, did not appear until three months later. Since then the ELECTRICAL WORLD has subjected the report as a whole to very close scrutiny to determine whether or not the conclusions presented in Part I were justified by the facts. Such an investigation has involved a great deal of labor, but has established beyond doubt the unreliability of the report as a government document and that a gross injustice has been done to a large part of the electrical industry which has been unfairly assailed and accused, by innuendo at least, of transgressing the law.

It is evident from the scope the inquiry was made to take, that animus was at the bottom of many of the conclusions. The resolution directed the Secretary of Agriculture to

"Furnish the Senate with all information in his possession as to the ownership and control of the water-power sites in the United States, showing what proportion of such water-power sites is in private ownership and by what companies and corporations such sites and private ownership are owned and controlled; what horsepower has been developed and what proportion of it is owned and controlled by such private companies and corporations, and any facts bearing upon the question as to the existence of a monopoly in the ownership and control of hydroelectric power in the United States."

This the report did not do. In sins of omission it is as grievously at fault as in sins of commission. The scope of the inquiry was extended, the report states, to

"Deal with the amount of developed power in all the States, whether water-power, steam-power or gas-power, and whether developed by public service corporations, by industrial corporations or by municipalities. The inquiry has been made thus extensive because only by such means can a clear understanding be had of the relation of water-power development to general power development and of the movement toward concentration of control in the electric power industry."

ALL POWER NOT INCLUDED

Whether or not there was reason for extending the inquiry, as stated by Mr. Merrill, to include power not generated by the use of flowing water, is a debatable question. It is certain, however, that to compare all water-power developments with incomplete data on other sources of power only serves to greatly magnify the importance of water-power developments. The total primary power of the United States as of 1912 is summarized in the report at 30,448,246 hp., whereas the total primary power employed in the United States is easily three times that amount. The Interstate Commerce Commission has been quoted as estimating the power developed by steam locomotives alone at 45,000,000 hp. It is evident, therefore, that a very marked change in the showing would result from an accurate statement of actual power developed otherwise than by the use of water.

IRRELEVANCY OF INCLUDING COSMOPOLITAN STEAM STATIONS

To those acquainted with the electric light industry, it is evident that in any discussion of hydroelectric power the engineer of the Forest Service who made the report went far afield to include large properties, as, for instance, the Commonwealth Edison Company of Chicago, the Consolidated Gas Company of New York, the Public Service Corporation of New Jersey, the Interborough-Metropolitan Company of New York, the Edison Electric Illuminating Company of Boston, the Philadelphia Rapid Transit Company, the Kings County Electric Light & Power Company of Brooklyn, the Indianapolis Light & Heat Company, the United Illuminating Company of Connecticut, and the numerous other companies which operate purely steam stations in large centers and are not even remotely connected with water-power development.

That these various properties are large no one will deny. But would it be reasonable to expect small stations in cities like Chicago, New York, Brooklyn, Philadelphia and Boston? Any public utility serving a city with 1,000,000 inhabitants must of necessity be large, but why any of these utilities should be drawn into any water-power controversy is not obvious, except it be to becloud the issue. The table reproduced, therefore, from the report, while it appears to be a god of gold, in reality has hands of brass and feet of clay. It is an interesting compilation, nothing more.

MISLEADING USE OF POPULATION COMPARISONS

Throughout the report fallacious conclusions are drawn where the population is used in comparisons of power development cost, indebtedness, earnings, etc. The report uses this method to show intensity of development, whereas it really shows nothing whatsoever. It only serves to accentuate out of all perspective the rate of development in the different regions as compared with the number of inhabitants, and thus gives to the sparsely settled Western States a false aspect of enormous development.

Intensity of development depends on the use of power and not on the number of inhabitants. The District of Columbia, with a small area, for instance, has almost the population of the State of Montana with a large area. Assuming that it produced the same developed horsepower by the methods used in the report, the same intensity of development would be indicated. Yet it is obvious that development in the former would under these circumstances be far more intense than in the latter.

A table entitled "total primary power capacity per thousand of population in 1912, 1907 and 1902" gives the leading places to New Hampshire and Maine and Vermont. These three States have, comparatively

TABLE TAKEN FROM REPORT OF SECRETARY OF AGRICULTURE, SHOWING EIGHTY-FIVE PUBLIC-SERVICE CORPORATIONS EACH OF WHICH CONTROLS NOT LESS THAN 30,000 HP. OF PRIMARY POWER

No.	Name of Company	No. of States	No. of Stations	Individual Totals			Cumulative Totals		Individual Percentages		Cumulative Percentages	
				Water-Power	Steam and Gas Power	All Power	Water-Power	All Power	Water-Power	All Power	Water-Power	All Power
1	Stone & Webster	13	62	340,211	189,643	529,854	340,211	529,854	6.36	3.56	6.36	3.56
2	Commonwealth Edison Co. (Ill.)	1	4	0	511,150	511,150	.....	1,041,004	0	3.44	....	7.00
3	Consolidated Gas Co. (N. Y.)	1	8	0	481,895	481,895	.....	1,522,899	0	3.24	....	10.24
4	North American Co	3	30	5,583	420,377	425,960	345,794	1,948,859	0.11	2.86	6.47	13.10
5	H. M. Byllesby & Co	17	53	116,155	160,341	276,496	461,949	2,225,355	2.17	1.86	8.64	14.96
6	E. W. Clark & Co. Management Corporation	4	36	162,330	103,365	265,695	624,279	2,491,050	3.04	1.79	11.68	16.75
7	Pacific Gas & Electric Co. (Cal.)	1	13	152,080	108,540	260,620	776,359	2,751,670	2.84	1.75	14.52	18.50
8	Interborough Metropolitan Co. (N. Y.)	1	2	0	246,500	246,500	.....	2,998,170	0	1.66	....	20.16
9	Public Service Corporation of New Jersey	1	16	0	232,905	232,905	.....	3,231,075	0	1.57	....	21.73
10	Doherty Operating Co.	14	43	43,100	180,401	223,501	819,459	3,454,576	0.81	1.50	15.33	23.23
11	Southern Power Co. (S. C., N. C.)	2	9	157,850	47,010	204,860	977,309	3,659,436	2.95	1.38	18.28	24.61
12	Utah Securities Corporation	3	43	171,702	30,374	202,076	1,149,011	3,861,512	3.21	1.36	21.49	25.97
13	Brooklyn Rapid Transit Co. (N. Y.)	1	5	0	198,025	198,025	.....	4,059,537	0	1.33	....	27.30
14	Pacific Light & Power Corporation (Cal.)	1	13	117,950	79,300	197,250	1,266,961	4,256,787	2.21	1.32	23.70	28.62
15	Montana Power Co.	1	19	179,700	8,300	188,000	1,446,661	4,444,787	3.36	1.27	27.06	29.89
16	International Paper Co	5	23	156,830	29,945	186,775	1,603,491	4,631,562	2.94	1.25	30.00	31.14
17	United Gas & Electric Corporation of Connecticut	9	17	5,250	181,110	186,360	1,608,741	4,817,922	0.09	1.25	30.09	32.39
18	Commonwealth Power, Railway & Light Co	4	47	70,813	112,160	182,973	1,679,554	5,000,895	1.32	1.24	31.41	33.63
19	The Philadelphia Co. (Penn.)	1	10	0	161,508	161,508	.....	5,162,403	0	1.08	....	34.71
20	Hydroelectric Power Co. of Niagara Falls	1	3	153,000	0	153,000	1,832,554	5,315,403	2.86	1.03	34.27	35.74
21	Edison Electric Illuminating Co. (Mass.)	1	3	0	140,850	140,850	.....	5,456,253	0	0.95	....	36.69
22	Central States Electric Corporation (Ohio)	1	1	0	135,700	135,700	.....	5,591,953	0	0.91	....	37.60
23	Southern California Edison Co	1	11	56,400	79,120	135,520	1,888,954	5,727,473	1.06	0.91	35.33	38.51
24	Georgia Railway & Power Co	1	7	100,400	33,720	134,120	1,989,354	5,861,593	1.88	0.90	37.21	39.41
25	Boston Electric Railways Co. (Mass.)	1	6	0	126,300	126,300	.....	5,987,893	0	0.85	....	40.26
26	Washington Water Power Co	2	5	109,200	16,000	125,200	2,098,554	6,113,093	2.04	0.85	39.25	41.11
27	Pennsylvania Water & Power Co	1	2	118,000	0	118,000	2,216,554	6,231,093	2.21	0.79	41.46	41.90
28	The Niagara Falls Power Co. (N. Y.)	1	2	115,000	0	115,000	2,331,554	6,346,093	2.15	0.77	43.61	42.67
29	Western Power Co. (Cal.)	1	4	73,330	38,670	112,000	2,404,884	6,458,093	1.37	0.76	44.98	43.43
30	American Gas & Electric Co	5	20	0	109,970	109,970	.....	6,568,063	0	0.74	....	44.17
31	Philadelphia Rapid Transit Co	1	5	0	105,730	105,730	.....	6,673,793	0	0.71	....	44.88
32	N. Y., N. H. & H. R. R. Co	3	16	8,050	96,500	104,550	2,412,934	6,778,343	0.15	0.70	45.13	45.58
33	W. S. Barstow & Co., Inc	7	32	13,475	82,545	96,020	2,426,409	6,874,363	0.25	0.65	45.38	46.23
34	N. Y. C. & H. R. R. R. Co	1	4	22,325	70,800	93,125	2,448,734	6,967,488	0.42	0.62	45.80	46.85
35	American Power & Light Co	4	40	22,978	69,221	92,199	2,471,712	7,059,687	0.43	0.62	46.23	47.47
36	Twin City Rapid Transit Co. (Minn.)	1	3	25,000	66,700	91,700	2,496,712	7,151,387	0.47	0.62	46.70	48.09
37	Alabama Traction, Light & Power Co	1	7	72,500	18,920	91,420	2,569,212	7,242,807	1.35	0.61	48.05	48.70
38	United Railways Investment Co. (Cal.)	1	5	65,600	25,330	90,930	2,634,812	7,333,737	1.23	0.61	49.28	49.31
39	Middle West Utilities Co	9	113	16,824	69,890	86,714	2,651,636	7,420,451	0.31	0.59	49.59	49.90
40	Pennsylvania R. R. Co	2	2	0	85,370	85,370	.....	7,505,821	0	0.57	....	50.47
41	New England Power Co. of Maine	2	7	80,700	700	81,400	2,732,336	7,587,221	1.51	0.55	51.10	51.02
42	Lehigh Coal & Navigation Co. (Pa.)	1	4	5,367	70,500	75,867	2,737,703	7,663,088	0.10	0.51	51.20	51.53
43	Kings County Electric Light & Power Co. (N. Y.)	1	3	0	74,670	74,670	.....	7,737,758	0	0.50	....	52.03
44	San Joaquin Light & Power Corporation (Cal.)	1	8	40,150	28,950	69,100	2,777,853	7,806,858	0.75	0.47	51.95	52.50
45	Ohio Traction Co	1	6	0	65,611	65,611	.....	7,872,469	0	0.44	....	52.94
46	Virginia Railway & Power Co	1	4	19,000	46,420	65,420	2,796,853	7,937,889	0.36	0.44	52.31	53.38
47	Illinois Traction Co	3	36	4,415	59,026	63,441	2,801,268	8,001,330	0.08	0.42	52.39	53.80
48	United Railways & Electric Co. of Baltimore	1	4	0	61,875	61,875	.....	8,063,205	0	0.42	....	54.22
49	Northwestern Power Co. (Minn.)	1	2	57,000	4,670	61,670	2,858,268	8,124,875	1.07	0.42	53.46	54.64
50	C. H. Tenney & Co	4	18	10,730	50,728	61,458	2,868,998	8,186,333	0.20	0.41	53.66	55.05
51	Public Service Co. of Northern Illinois	1	13	5,300	55,930	61,230	2,874,298	8,247,563	0.10	0.41	53.76	55.46
52	American Water Works & Electric Co	3	14	0	59,097	59,097	.....	8,306,660	0	0.40	....	55.86
53	Consolidated Gas, Electric Light & Power Co. (Md.)	1	7	1,000	56,710	57,710	2,875,298	8,364,370	0.02	0.39	53.78	56.25
54	Massachusetts Electric Cos	1	13	0	57,575	57,575	.....	8,421,945	0	0.38	....	56.63
55	Pillsbury Flour Mills Co. (Minn.)	1	2	57,500	0	57,500	2,932,798	8,479,445	1.07	0.38	54.85	57.01
56	Washington Railway & Electric Co. (D. C.)	1	1	0	53,800	53,800	.....	8,533,245	0	0.37	....	57.38
57	Kansas City Railway & Light Co. (Mo.)	1	1	0	53,300	53,300	.....	8,586,545	0	0.36	....	57.74
58	Carolina Power & Light Co. (N. C.)	1	9	44,400	7,725	52,125	2,977,198	8,638,670	0.83	0.35	55.68	58.09
59	American Gas Co	5	17	15,525	36,350	51,875	2,992,723	8,690,545	0.29	0.35	55.97	58.44
60	United Light & Railways Co	2	7	500	50,025	50,525	2,993,223	8,741,070	0.01	0.34	55.98	58.78
61	New England Investment Co. (Mass.)	1	4	49,400	0	49,400	3,042,623	8,790,470	0.93	0.33	56.91	59.11
62	Nevada-California Power Co. (Cal.)	1	7	37,750	10,670	48,420	3,080,373	8,838,890	0.70	0.33	57.61	59.44
63	Detroit United Railways	1	9	0	46,986	46,986	.....	8,885,876	0	0.32	....	59.76
64	Colorado Power Co	1	7	41,750	4,870	46,620	3,122,123	8,932,496	0.78	0.31	58.39	60.07
65	J. G. White & Co	4	17	20,880	25,599	46,479	3,143,003	8,978,975	0.39	0.31	58.78	60.38
66	American Public Utilities Co	3	9	13,350	31,895	45,245	3,156,353	9,024,220	0.25	0.30	59.03	60.68
67	American Light & Traction Co	4	5	13,400	31,584	44,984	3,169,753	9,069,204	0.25	0.30	59.28	60.98
68	Louisville Traction Co	1	2	0	44,130	44,130	.....	9,113,334	0	0.30	....	61.28
69	United Gas Improvement Co	4	9	350	43,641	43,991	3,170,103	9,157,325	0.01	0.30	59.29	61.58
70	Chattanooga & Tennessee River Power Co. (Tenn.)	1	1	42,000	0	42,090	3,212,103	9,199,325	0.79	0.28	60.08	61.86
71	National Securities Corporation	2	4	39,350	2,000	41,350	3,251,453	9,240,675	0.73	0.28	60.81	62.14
72	Indianapolis Light & Heat Co	1	1	0	40,900	40,900	.....	9,281,575	0	0.27	....	62.41
73	Niagara, Lockport & Ontario Power Co. (N. Y.)	1	1	40,000	0	40,000	3,291,453	9,321,575	0.75	0.27	61.56	62.68
74	Aluminum Co. of America (N. Y.)	1	2	40,000	0	40,000	3,331,453	9,361,575	0.75	0.27	62.31	62.95
75	Columbia Gas & Electric Co. (Ohio)	1	1	0	38,930	38,930	.....	9,400,505	0	0.26	....	63.21
76	Georgia Light, Power & Railway Co	1	3	33,000	4,750	37,750	3,364,453	9,438,255	0.62	0.26	62.93	63.47
77	Turners Falls Power Co. (Mass.)	1	2	36,900	0	36,900	3,401,353	9,475,155	0.69	0.24	63.62	63.71
78	Pacific Lighting Corporation (Cal.)	1	1	0	34,202	34,202	.....	9,509,357	0	0.23	....	63.94
79	Columbia Railway, Gas & Electric Co. (S. C.)	1	2	26,000	7,330	33,330	3,427,353	9,542,687	0.48	0.23	64.10	64.17
80	Northern Ohio Traction & Light Co	1	2	2,270	31,000	33,270	3,429,623	9,575,957	0.04	0.22	64.14	64.39
81	United Properties Co. (Cal.)	1	6	0	33,025	33,025	.....	9,608,982	0	0.22	....	64.61
82	Federal Light & Traction Co	7	12	0	32,373	32,373	.....	9,641,355	0	0.22	....	64.83
83	Fort Wayne & Northern Indiana Traction Co	1	3	0	32,160	32,160	.....	9,673,515	0	0.22	....	65.05
84	United Illuminating Co. (Conn.)	1	2	0	31,200	31,200	.....	9,704,715	0	0.21	....	65.26
85	General Electric Co. (N. Y.)	1	3	31,000	0	31,000	3,460,623	9,735,715	0.58	0.21	64.72	65.47
86	Union Carbide Co. (Mich.)	1	1	30,800	0	30,800	3,491,423	9,766,515	0.58	0.20	65.30	65.67
87	Cohoes Co. (N. Y.)	1	1	30,000	0	30,000	3,521,423	9,796,515	0.56	0.20	65.86	65.87
	Totals for eighty-seven corporations	48	1042	3,521,423	6,275,092	9,796,515	.....	.....	65.86	65.87	....	....
	Municipal stations	48	1600	231,525	496,984	728,509	3,752,948	10,525,024	4.33	4.90	70.19	70.77
	All other stations	48	4299	1,593,751	2,752,367	4,346,118	5,346,699	14,871,142	29.81	29.23	100.00	100.00
	Grand totals		6941	5,346,699	9,524,443	14,871,142						
	Total manufacturing power included			736,197	172,210	908,407						
	Central stations and electric railways, 1915			4,610,502	9,352,233	13,962,735						
	Central stations and electric railways, 1912			2,942,388	8,251,311	11,193,699						
	Increase 1912 to 1915			1,668,114	1,100,922	2,769,036						
	Per cent of increase			36.2%	11.8%	19.8%						

Note.—All but two of the corporations listed hereon, the International Paper Company (16) and the Union Carbide Company (86), are engaged in public-service operations.

speaking, small populations, but the manufacturing and quarrying industries are large and of a kind in which power is a large factor, such as pulp and paper, cotton and woolen mills, marble and granite quarries, etc. To compare with these States such sparsely settled States as Washington, Oregon, Montana and Utah is obviously irrational. In this classification Nevada, with 81,875 inhabitants and about 20,500 hp., is actually placed far ahead of Georgia, with 2,609,121 inhabitants and about 470,000 hp. No correct deductions can be drawn from such statistics. They only serve to distort and magnify the growth of the industry and the increase in capitalization, in cost, and in earnings in the newer and more sparsely settled portions of the country. If, therefore, the percentage increase method of expression be interpreted in terms of actual increase, a diametrically opposite conclusion results.

MUNICIPAL VERSUS CENTRAL STATION PLANTS

The unsoundness of much of the reasoning used throughout the report is no more apparent than in the comparisons made between the cost per horsepower of installation of municipal central stations as compared with the cost per horsepower of installation of commercial central stations. The conclusion is reached that the figures for the municipal central stations show more accurately the actual cost of such enterprises per horsepower than do the figures for the commercial central stations, with an obvious inference.

Here, again, an attempt is made to compare things not comparable. The United States Census figures show that in 1912 there were among the 1562 municipal stations 269 water wheels, having an aggregate rating of 130,261 hp. The same authority shows that among the 3659 commercial central stations there were 2664 water wheels with an aggregate rating of 2,340,000 hp.

It is an established fact that the cost of water-power installations is far greater than that of steam-power installations. Central stations being greater users of water-power for generating purposes than municipal plants, it is therefore obvious that their cost of installation should be higher. Moreover, the lines of the central stations extend out beyond the boundaries of cities into sparsely-settled country, which is not true of municipal systems, so that here again the cost of installation will necessarily be higher. However, the difficulty of arriving at correct conclusions regarding municipal systems is very great, as is well known by everyone connected with the electric lighting industry. In commenting on municipal plants, an absolutely unbiased authority, the Bureau of the Census, says:

"Many of the municipalites operating electric stations do not have systems of bookkeeping which are adapted to the uniform system of accounts generally employed by the commercial stations. A lighting plant is often operated not upon a separate basis, but as one of the branches of the utilities of the municipality, and some other branch of the utilities may not only absorb the surplus and supply the deficit, but use the income, which often is not commensurate with the services rendered for various purposes, and may impose upon the electric plant, without adequate reimbursement, many expenses in the way of service.

"Under these conditions, the comparison of the cost of construction, equipment and real estate with the funded debt, cash investments and real estate mortgages has but little significance. The additions and betterments are often made by a special tax levy or a sum voted for the purpose out of the general receipts from taxation without any additional encumbrance being placed on the plant. With many stations, the balance sheet is really a yearly statement rather than an accumulative summary of the financial conditions."

It should be pointed out, also, that municipal plants are not supposedly operated for profit, command capital at a lower rate of interest, and are for the most part established in communities where private capital at the time refused to invest. Of the 1600 municipal plants in existence, approximately 85 per cent of them are in cities and villages of less than 5000 population and only 1 per cent in cities of more than 100,000 population. As the network of private transmission systems spreads over more and more of the country, it is safe to assume, in fact, it is almost inevitable, that the number of municipal generating systems will become less and less, because municipalities will find it cheaper to purchase the energy from the transmission systems. The water-power report itself supplies figures to combat its own conclusions. It appears from the report that it required 84.5 per cent of the gross revenues of municipal plants to pay operating expenses, while the commercial stations are operated on a basis of 62.5 per cent.

AS TO OVER-DEVELOPMENT

In an attempt to prove over-development on the Pacific Coast, the report makes the following statement:

"While the use of electric power for all purposes except manufactures is greater in the Western States than in any other section of the country, as it will appear from a later consideration of electric power output, and this greater use explains in a large degree the extent of primary power installation, there is also at the present time a considerable over-development in nearly all the power centers of the Western States. In California, for example, where the installation in commercial central stations was more than 1,000,000 hp., the sum of the peak loads of the individual plants in 1914 was only slightly in excess of 700,000 hp. The sum of the simultaneous peaks on the several power systems probably did not exceed 600,000 hp. If so, there was in commercial central stations in California in 1914 an installation of 400,000 hp. in excess of all demand."

The logical inference from such a statement is that a holding company should be formed to tie all of the generating systems in California together (if that were practicable) so as to conserve water-power, investment, etc. That is the only practical way of avoiding excessive simultaneous peaks on disconnected electric systems. It is standard practice for every important central station to safeguard its supply. For that reason nearly all of the companies owning hydroelectric systems also have huge steam stations held in reserve for emergency use, and to supply the demand when there is not sufficient water-power available for the load. This is ordinary, every-day, common-sense engineering, and cannot be considered as over-development.

For the purpose of showing the fallacy of the government's conclusions we cite the following California statistics taken from the columns of the ELECTRICAL WORLD and gathered by members of its staff in the field. The figures are for the year 1914.

Name of Company	Water-Power Installation, Kw.	Steam-Power Installation, Kw.	Total Installation, Kw.	Peak Load, Kw.
Pacific Gas & Electric Company.	90,310	82,300	172,110	124,000
Great Western Power Company.	50,000	32,000	82,000	56,300
Sierra & San Francisco Power Company	38,000	18,000	56,000	40,080
Southern California Edison Company	28,500	57,600	86,100	53,835
Pacific Light & Power Corporation	75,000	42,000	117,000	70,565

Thus in only one case was the hydraulic installation sufficient to carry the peak load, and in that case, Pacific Light & Power Corporation, it is interesting to note that circumstances were such that it was necessary to generate 21,000,000 kw.-hr. of electrical energy in steam stations.

How to Reduce the High Cost of Valuation

Dr. Milo R. Maltbie Discusses the Growing Feeling That Valuations Are Sometimes So Expensive and Unreliable That They Are Scarcely Worth the Time and Money They Require

SEVENTH IN A SERIES OF "TALKS IN THE INDUSTRY"

BY FREDERIC NICHOLAS

"I DO not consider that a valuation is always necessary in order that rate cases may be settled," said Dr. Maltbie. "It is necessary for the public authorities to have at least a general idea of the value of a property in order that rates may not be confiscatory and yet not so high as to return an unusually large profit. But in many cases where the properties are not too complex there are rough methods of determination which may be used to arrive at approximate values without the detailed, lengthy and expensive valuations that have often been followed.

"Of course, in a case that is likely to go to the courts, such methods of approximation cannot ordinarily be used with safety because the courts will not accept them, however justified they may be in reality. Hence unless a company is willing to accept rates brought about by negotiation or to accept the finding of some arbitrator or board of arbitration without resort to the courts, it is almost necessary to have some sort of a valuation.

Detailed valuations of public utilities are conducted at high cost for the company and the public. The expense of making them is part of the expense of operation and it is borne, in the end, by the ultimate consumer. In the recent Philadelphia valuation, involving an estimated cost of $200,000, the State commission held sixty-six sessions and heard testimony which filled 110 volumes containing 8500 pages. The economic advantage of reducing expenditures of this character, where this is possible with protection of the rights of all concerned, is receiving much serious consideration.

Dr. Milo R. Maltbie, who has discussed some of the questions concerned in this problem for the "Electrical World," is the chamberlain of New York City. He was a member of the original Public Service Commission of the First District of New York. After his retirement he became a member of the advisory board to C. A. Prouty, director of the valuation division of the Interstate Commerce Commission. In his present office the duties of Dr. Maltbie are to represent New York City in public utility matters.

VALUATION NECESSARY IN COURT CASES

"In case an approximate valuation clearly shows that rates cannot be reduced, a detailed valuation is obviously unnecessary; it would simply confirm a conclusion already reached. But where the question is not easily disposed of, and the matter may go into the courts, it is almost always necessary, under judicial decisions, to have a valuation. The courts, and particularly the United States Supreme Court, have been careful to say that rates may be fair and reasonable which would not allow a return upon original cost or cost of reproduction, less depreciation, for the amount of return upon such costs is not the only test; and particularly is this true where bad judgment in the development of the property has been shown. In such cases, rates may be fixed on other bases, and there have come to be standard rates of charge which would undoubtedly be held reasonable regardless of the return on the property.

"There is a growing feeling that valuations are sometimes so expensive and so unreliable that they are hardly worth the time and money they consume. Certainly there is a growing distrust of valuations that are made apparently for trading purposes in rate cases. The layman finds it difficult to understand how one engineer can say that a certain property has a value of $25,000,000 and another engineer finds the fair value of the same property to be $50,000,000, and perhaps another engineer gives in his testimony a value of $70,000,000.

"The layman may not know which one is right, but he is convinced that all cannot be right, and probably concludes that all are wrong. What the layman thinks is probably in the minds of the courts and commissions, although they, being more discreet, are less apt to announce it publicly.

ENGINEERING VARIATION CANNOT BE GREAT

"As a matter of fact, there cannot be such a great variation between engineers who are earnestly and fairly trying to determine the amount upon which a company is justly entitled to a return, if they adhere to engineering matters. Any man who has had any experience with public utilities knows that when an engineer wishes to approximate the fair cost for rate-making purposes, he is able to do so within a range of 20 or 30 per cent. Furthermore, those 'experts' who have been able in the past, through the use of their imagination and resort to a dictionary of synonyms for a multiplicity of phrases, to manufacture 'values' step by step have had little influence with courts and commissions and deservedly so.

"Every public official upon whom falls the responsibility for determining rates has a great respect for the honest opinion of experts upon technical matters, but there has been a growing suspicion that many valuations have been inflated for the purpose of compromise; consequently, the expert who has the greatest influence is the man who is fair, who makes no attempt to increase values by multiplying items and who leaves to the lawyers all matters of law and argument, confining himself to facts and to cost figures which have a direct relation to practical affairs.

FACT AND OPINION

"In general, the valuation of a property consists of two groups of factors, one containing facts usually ascertainable with ease, and the other matters of opinion. For example, whether an electric company has 2560 chestnut poles 30 ft. in length, is a question that ought to be answered easily. No great difference of opinion ought to be found concerning either the number or the length. There is no reason why any fair engineer representing the public or the consumers should not agree with another fair engineer representing the company. Even in the case of property underground, the possibility of disagreement ought to be so small as to be negligible. Indeed, one might say generally that the listing of a company's property by two sets of engineers ought to be unnecessary and, as a rule, avoided.

"There are matters of opinion, such as whether a certain property is used or useful, how long it will continue to be operated, what is its fair value, etc., about which equally fair and impartial men might differ, and it will probably not be possible to reduce questions connected with the valuation of property to such a simple status that engineers will not disagree. But in my opinion, if engineers confine themselves to engineering matters and do not undertake to cover in their testimony the whole range of issues from the cost of buying a chestnut pole to the legal question of what the Fourteenth Amendment means or the financial question of what it costs to raise money for a public utility, they will find that their problems have been simplified and that the difference of opinion is relatively small.

Settlement in Philadelphia Case

"What can be accomplished in this direction may be illustrated by one chapter of the Philadelphia rate case before the Pennsylvania Public Service Commission. A committee composed of James M. Boyle of Sanderson & Porter, representing the company; F. W. Ballard, representing the complainants (Morris L. Cooke and others), and myself, representing the Public Service Commission, undertook to ascertain the actual *net* cost of the physical property of the company. A report was prepared and accepted by all of the committee and submitted to the commission. There was no minority report, and yet within the limited time allotted to the committee it was able to ascertain the actual cost of only about 50 per cent of the actual property and had to estimate the remainder. If this is possible with property totaling $24,000,000, why is it not possible to reach similar results with other properties?"

Testing Highway Characteristics with the Electric Vehicle

Prof. Dugald C. Jackson of the Massachusetts Institute of Technology outlined the results of a recent investigation of electric vehicle traction on highways at a meeting of New England electric truck, supply and central station men in Boston not long ago. The tests were conducted mainly in 1915 under the immediate direction of Dr. A. E. Kennelly and Otto R. Schurig of the research division of the electrical engineering department, and emphasize the importance of smooth pavements in motor-vehicle operation. It is expected that the details of the investigation will be published by the Institute in a special bulletin within the next three months.

The tests were made possible through the co-operation of Thomas A. Edison, the Gould Storage Battery Company, the General Vehicle Company and the Edison Electric Illuminating Company of Boston. They were made with a 1000-lb. electric delivery wagon equipped with solid tires, roller bearings and provided with a worm drive and differential gearing. Before the road tests were made the vehicle was operated in the laboratory to determine its efficiency from battery terminals to wheel rims. This ranged from a maximum of 55 per cent on the first position of the controller handle to a maximum of 78 per cent on the fourth or final position. In most of the runs the efficiency varied between 60 per cent and 75 per cent.

Comparative data for level highways of different construction and condition were expressed in the pounds per short ton required to propel the vehicle on a level roadway at various speeds, including the air resistance with no wind blowing, but not including the internal losses in the truck. On tar macadam in good condition and wet, the tractive resistance east-bound varied from 27 lb. per ton at 12 m.p.h. to 30 lb. at 15.5 m.p.h.; west-bound the tractive effort varied between 20 lb. per ton at 10 m.p.h. and 24 lb. at 14 m.p.h. On an asphalt road in fair condition the tractive effort ranged from 20 lb. per ton at 10 m.p.h. to 24 lb. at 15.5 m.p.h. With the asphalt in poor condition the tractive effort was increased about 10 per cent. Eliminating the air resistance a constant tractive effort of 17 lb. per ton was required between 10 m.p.h. and 15 m.p.h. on asphalt pavement.

On wood-block pavement in good condition the tractive effort ranged from 22 lb. per ton at 10 m.p.h. to 24 lb. at 14.5 m.p.h. In general, eliminating wind effect, the resistance of wood-block paving was about 15 per cent greater than that of asphalt. Brick paving in good condition showed a slight increase in resistance over the wood blocks, and with the bricks slightly worn the resistance ran up somewhat higher. Tar macadam in good condition showed about the same resistance as an ordinary waterbound macadam with a fine surface in good shape. A 50 per cent increase resulted from a macadam road in poor condition through holes. The resistance of heavily-oiled macadam roads was rather high, and between 7 and 13 m.p.h. on a freshly-tarred, soft road the resistance varied between 32.5 and 35 lb. per ton.

Gravel and cinder roads showed about 10 or 15 per cent more resistance than good macadam. Granite block paving proved to be the worst road for mechanical trucking, a road of this type on a concrete base, but with sand and gravel interstices, showing two and a half times the resistance of asphalt or wood blocks, the resistance of a granite block road with cement joints being about 60 per cent greater than that of asphalt. With a granite road the resistance increases with speed when the still air resistance is eliminated, due to impact resistance. Asphalt, as stated, gives a straight-line plot of tractive effort and speed between 10 and 15 m.p.h.

In general, an asphalt road may be said to be equivalent to an approximate grade of 1 per cent and a granite block road to grades of 1.7 to 2.15 per cent, depending upon the speed. The tests verified the data published in the Electrical World of May 17, 1913, page 1040, in which asphalt was taken as 100 per cent resistance and in which the following values were recorded for other types of road: waterbound and tar macadam, 115 per cent, and granite block, sand filled, from 200 to 250 per cent. A heavy snow on a macadam or asphalt road increases the resistance from 70 to 90 per cent, and very hard snow adds about 33 per cent to the resistance.

These data emphasize the importance of adopting types of residential thoroughfare construction in downtown streets of cities as the motor vehicle displaces the horse. Eventually smoother roadways must be employed in American cities as in London, Paris, Berlin and other European centers. Such roadways will mean an increased radius of service for the electric truck, owing to the enlarged mileage secured per battery charge resulting from decreased traction requirements. Mr. Schurig then stated that the power losses of the test truck were as follows, on the basis of 100 lb. total horizontal pull at 15 m.p.h. to overcome all resistances: Air resistance, 10 lb.; transmission, 10 lb.; rolling resistance, macadam road, 60 lb.; motor and control system, 20 lb. The transmission efficiency of 90 per cent from armature to rear wheels includes the complete system.

Closing, Professor Jackson said that the investigation should be continued for at least another year in order to enable the effect of different chassis, spring systems, etc., to be studied. Because of its power-measuring capabilities, the electric vehicle is an unusually valuable device in the study of road conditions.

For the Convenience of the Customer

How the Telephone Is Used by the Commonwealth Edison Company to Facilitate Customers' Applications and Inquiries—Prompt Service in Making Minor Emergency Repairs —Promoting Speed in Installation Departments

THE Commonwealth Edison Company of Chicago, during the last few years, has devoted much time and effort to produce a system which will make its service easy for the prospective customer to get and easy for him to utilize after he gets it. Broadly speaking, one general plan of organization is effective throughout the system. Different detailed methods and practices which seem best adapted to meet conditions as they exist have been worked out for each department.

The broad plan of organization may be outlined as one which, through the telephone, links the company's 268,000 customers with a mammoth twenty-two position private exchange, the largest private exchange in the world. Through the facilities of this exchange the inquiring customer or prospect can, without delay or questioning, be shifted to a sub-group of operators who give the calling party what he or she wants. This sub-group may be telephonic salesmen, telephonic service men, or work dispatchers, but regardless of what they are called, they are men provided with the knowledge and facilities for quickly and tactfully satisfying the customer. The work dispatchers are office men who direct the efforts of the field men, keeping in hourly touch with them over the telephone. The dispatchers also relieve the field men of a great proportion of their clerical duties so that they may devote maximum time to actual field work.

"HELLO! RANDOLPH 1280"?—ANSWER, "EDISON COMPANY"

Applications for electric service arrive through one of three channels. They may be taken by field or counter salesmen direct, they may arrive by mail, or they may be taken over the telephone. Applications received through the latter channel perhaps cause the customer the least inconvenience, and, since it is the aim of the company to make electric service easier to get, a great deal of effort has been given to perfecting a system which will permit the customer to use the telephone. At the same time the facilities for taking applications over the counter have been splendidly enhanced by the equipment of Customers' Hall.

That the company's efforts to make service easy to get are meeting with success is evidenced by the fact that the number of applications taken by telephone in 1913, in 1914 and in 1915, respectively, were 21,264, 33,563 and 45,976. During the busiest hour of the year 1915, that is, on April 29, the company's main exchange handled 1425 incoming calls, of which 510, or an average of ten per minute, were directed to the application bureau. During the corresponding hour of the 1916 peak, calls were handled at the rate of 12.5 per minute.

The telephone calls received by the application-bureau telephone board on Monday, May 1, of this year, the peak day of present spring, numbered 3816. The number of calls for the corresponding peak day of the spring of 1915 was 3178. The calls received during the first hour by the same board on May 1, 1916, numbered 754, as against 566 for the first hour of the peak day of the spring of the preceding year.

During the last three years the number of applications received by mail was as follows: In 1913, 6531; in 1914, 8102, and in 1915, 5993, or an average per day of twenty-two, twenty-seven and twenty, respectively. The actual number of contracts, which, of course, does not indicate the gross volume of business taken by the salesmen in these three years, was, in 1913, 15,934; in 1914, 12,228, and in 1915, 9949, which, reduced to a daily basis, amounts to fifty-three, forty-one and thirty-three, respectively.

NO APPLICATIONS AT ELECTRIC SHOP—TELEPHONE IS QUICKER

The actual number of contracts taken over the counter at the company's several offices in the three years shows a slight increase, but the percentage of total applications shows a decrease for each succeeding year. The facilities for taking applications over the counter have, therefore, been increased and made more attractive during that period. More and more people, however, want the quicker service which they can get only by telephone. The number of applications taken by the meter department has remained almost stationary, while those taken at the Michigan Avenue Electric Shop have been reduced to zero because of the fact that the clerks and the manager of this store immediately assist patrons desiring to make application for service to do so over a telephone made convenient for the purpose. This plan is followed in order that the applications may go through the speedier channels provided at the main office and not be delayed in being transferred from the Electric Shop to the main office.

DISTRIBUTION OF RESIDENCE CONTRACTS TAKEN DURING THREE YEARS

	Counter	Phone	Mail	Salesmen	Meter Department	Michigan Ave. Electric Shop Total
1913.....	24,650	21,264	6,531	15,934	4,329	2,470
1914.....	26,617	33,563	8,102	12,228	5,089	2,060
1915.....	33,197	45,976	5,993	9,949	5,548	1

The fact that a single experienced telephonic salesman was able during a busy period to take 225 applications in a single working day, demonstrates perhaps better than annual figures can, what great speed and efficiency the company's system makes possible.

Of the total residential contracts taken in 1915, about 51 per cent were successor contracts; 49 per cent represented new business and required meter installations; 11 per cent required services to be run as well as meters, and 1.2 per cent also required line extensions.

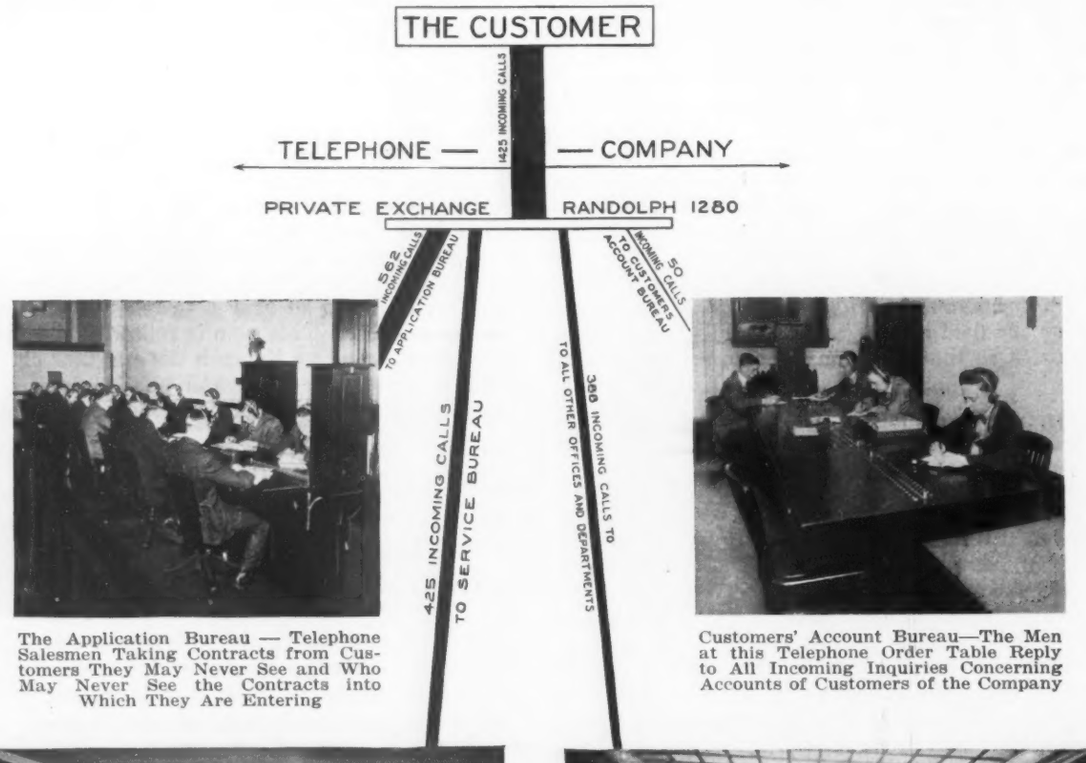
7,000,000 TELEPHONE CALLS A YEAR ARE SORTED

The physical apparatus installed for taking care of the customers' telephone applications and other requests may be described in brief as follows: The calls arrive first, of course, at the company's main telephone switchboard, through which approximately 7,000,000 calls pertaining to all phases of the company's business were handled in 1915; and from this mammoth group of 7,000,000 calls, about 220,000 calls, intended for the contract department, are intelligently and speedily assorted by the telephone operators and transferred to a twenty-position order table equipped especially to take care of this work and known as the application bureau. The men at this board are essentially telephonic salesmen who are continually on duty. They are experienced electrical salesmen. When a call is transferred to this

bureau it does not go directly to one of the salesmen, but the making of the physical connection flashes one of a group of lights at the end of the table. The call may then be picked up by any of the twenty telephonic salesmen who is not busy, without loss of time. He quickly and tactfully secures the information that any other salesmen would secure regarding the nature of the service desired, making notes of the data received upon a special application blank before him for this purpose. This penciled memorandum forms the basis of the application. The customer does not need to sign it. For the two rush periods of the year an auxiliary twelve-position board is maintained, so that a total of thirty-two experienced telephonic salesmen may be taking applications simultaneously. The order tables are not, of course, completely manned at all hours, but operators are recruited from the clerical force of the contract department when needed during rush hours.

All telephonic salesmen are under the supervision of one man—a supervisor—who, situated at a desk apart from the main board, may listen in on any conversation or may himself handle cases in which the calling party desires to speak to the manager. Connections are also provided from this application bureau board so that an officer of the company, without leaving the administrative floor, can hear conversations between employees and the public, and thus secure first-hand information as to the attitude or view of customers toward any branch of service; as, for instance, application bureau, or lamp renewals, or customers' accounts, or any particular improvement or lack of improvement which may be of interest to the management at a certain time.

From the application bureau board the penciled application filled out by the telephonic salesman is taken to a group of clerks and typists, where it is typed and where multiple copies of it are made to be forwarded to all departments interested. In this way the inspection department, the work of which immediately follows


THE CUSTOMER
1425 INCOMING CALLS
TELEPHONE — — COMPANY
PRIVATE EXCHANGE
RANDOLPH 1280
562 INCOMING CALLS TO APPLICATION BUREAU
50 INCOMING CALLS TO CUSTOMER'S ACCOUNT BUREAU
425 INCOMING CALLS TO SERVICE BUREAU
368 INCOMING CALLS TO ALL OTHER OFFICES AND DEPARTMENTS

The Application Bureau — Telephone Salesmen Taking Contracts from Customers They May Never See and Who May Never See the Contracts into Which They Are Entering

Customers' Account Bureau—The Men at this Telephone Order Table Reply to All Incoming Inquiries Concerning Accounts of Customers of the Company

The Service Bureau—Customers' Requests and Lamp Orders Received Here Are Sent from the Telephone Operator to the Work Dispatchers by Means of the Conveyor Belt Down the Center of the Building

The Various Offices and Departments of the Commonwealth Edison Company Occupy More than One-half of the Nineteen-story Edison Building. The Illustration shows the general office known as "Customers' Hall"

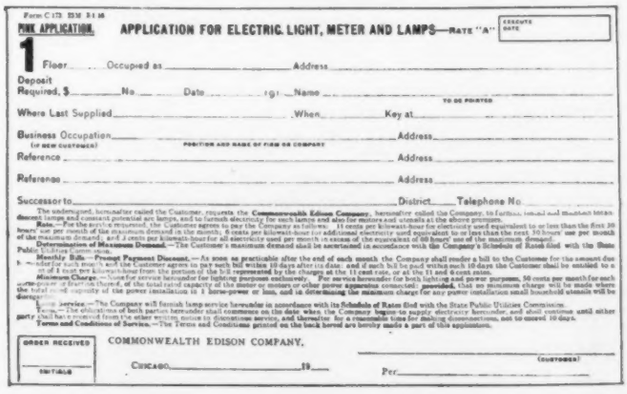
AN ANALYSIS OF THE DESTINATIONS OF TELEPHONE CALLS RECEIVED BY THE COMMONWEALTH EDISON COMPANY DURING A RECENT ONE-HOUR PERIOD

the contract department, is provided hourly with a typed and readable copy of the applications.

Besides taking applications the telephonic salesmen, without leaving their positions, can secure information on the status of any work in progress. They secure this information from a group of girls who, equipped with head-type telephones, sit before open-topped files which contain complete information concerning all applications for service pending more than one day and not yet connected to the company's lines. Data on these applications are filed according to the street number of the building in which the work is being done, so that in asking for the information the telephonic salesman merely gives the house number and the street to the girl at the information files. In order to avoid mistakes she answers with the name of the customer as soon as she has located the data pertaining to the job. If the name corresponds with the one which the calling party has given the telephonic salesman, he knows that it is correct information, receives it and transmits it to the customer.

MATURE JUDGMENT OF MEN EFFECTS A SAVING

Formerly girls were employed instead of men in the positions the telephonic salesmen now occupy. During 1913, the year in which this procedure was followed,



PINK APPLICATION. APPLICATION FOR ELECTRIC LIGHT, METER AND LAMPS—RATE "A"

1 Floor ... Occupied as ... Address ...

Deposit Required, $ ... No. ... Date ... 19... Name ...

Where Last Supplied ... When ... Key at ...

Business Occupation ... Address ...

Reference ... Address ...

Reference ... Address ...

Successor to ... District ... Telephone No. ...

The undersigned, hereinafter called the Customer, requests the Commonwealth Edison Company, hereinafter called the Company, to furnish, install and maintain incandescent lamps, and connect potential arc lamps, and to furnish electricity for such lamps and also for motors and utensils at the above premises.

Rate.—For the service requested, the Customer agrees to pay the Company as follows: 11 cents per kilowatt-hour for electricity used equivalent to or less than the first 30 hours' use per month of the maximum demand in the month; 6 cents per kilowatt-hour for additional electricity used equivalent to or less than the next 30 hours' use per month of the maximum demand; and 3 cents per kilowatt-hour for all electricity used per month in excess of the equivalent of 60 hours' use of the maximum demand.

Determination of Maximum Demand.—The Customer's maximum demand shall be ascertained in accordance with the Company's Schedule of Rates filed with the State Public Utilities Commission.

Monthly Bills.—Prompt Payment Discount.—As soon as practicable after the end of each month the Company shall render a bill to the Customer for the amount due hereunder for such month's use and the Customer agrees to pay such bill within 10 days after its date; and if such bill be paid within such 10 days the Customer shall be entitled to a discount of 1 cent per kilowatt-hour from the portion of the bill represented by the charge at the 11 cent rate, or at the 11 and 6 cent rates.

Minimum Charge.—Notwithstanding the foregoing provisions hereof, or otherwise, for both lighting and power purposes, 50 cents per month for each ... horse-power or fraction thereof, of the total rated capacity of the motor or motors or other power apparatus connected; provided, that no minimum charge will be made where the total rated capacity of the power installation is 1 horse-power or less, and in determining the minimum charge for any power installation small household utensils will be disregarded.

Street Service.—The Company will furnish lamp service hereunder in accordance with its Schedule of Rates filed with the State Public Utilities Commission.

Term.—The obligations of both parties hereunder shall commence on the date when the Company begins to supply electricity hereunder, and shall continue until either party shall have received from the other written notice to discontinue service, and thereafter for a reasonable time for making disconnections, not to exceed 10 days.

Terms and Conditions of Service.—The Terms and Conditions printed on the back hereof are hereby made a part of this application.

ORDER RECEIVED ... INITIALS

COMMONWEALTH EDISON COMPANY.

CHICAGO, ... 19...

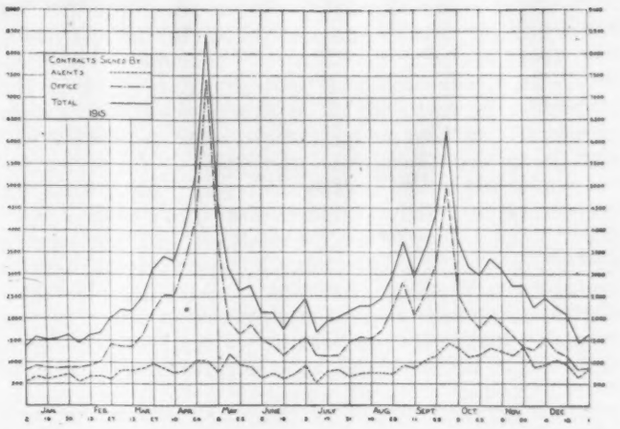
(CUSTOMER)

Per ...

APPLICATION FORM FILLED IN BY TELEPHONE SALESMAN

the department gave the salesmen of the contract department 30,365 tips or leads, and classified 16,806 incoming calls as inquiries. When the change was made, installing men in these positions in 1914, only 20,000 tips or leads were transmitted to the sales department, and 46,000 of the calls received were classified as inquiries. These figures, of course, indicate that the more mature commercial judgment of the telephonic salesmen in 1914 saved the field salesmen of the contract department the many miles of unnecessary traveling and walking which they would have endured had it not been possible for the men at the switchboard to handle many of the inquiries and give the customers the information desired without transmitting the cases to the sales department in the field. More important still, they saved to the customers many hours of waiting. Instead of telephoning for a salesman to bring a contract the residence customers now telephone for electric service and the transaction is closed in one or at most two minutes.

The flexibility of the telephone equipment in comparison with the flexibility of a group of counter or outside salesmen, is well indicated by the curves herewith, which show that while the business taken by the field salesmen over the counter and through the mail continued along with but a slight increase during the company's very busy period, the heavy peaks were taken by the telephone bureau by increasing the number of telephonic salesmen and information clerks.



CURVES WHICH SHOW THE FLEXIBILITY OF THE TELEPHONE ORDER-TAKING EQUIPMENT AS COMPARED WITH OTHER APPLICATION SOURCES. ELECTRICALLY SPEAKING, THE TELEPHONE ORDER-TAKERS ABSORB THE PEAKS

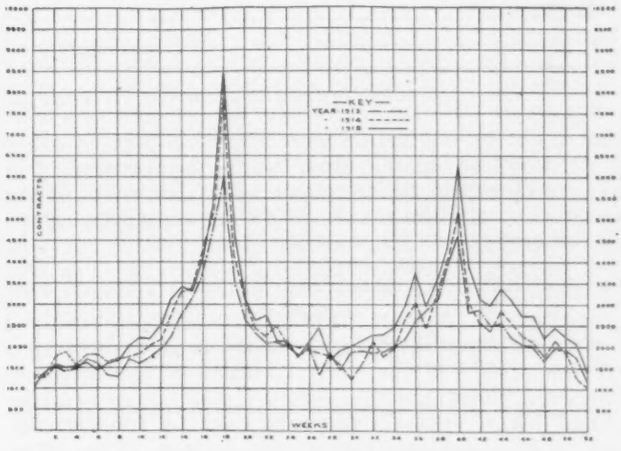
Besides the two large seasonal peaks of the year's business, which occur about May 1 and Oct. 1, there are other smaller peaks occurring at the first of each week. These are particularly marked on Monday morning and shortly after the lunch hour Monday afternoon. The chief clerk in charge of the telephonic salesmen has learned to anticipate these peaks, as well as other times of abnormal and subnormal business, and with considerable accuracy can estimate in advance how many telephonic salesmen will be needed at the board to handle the business arriving at that position for any predetermined time.

MASTER CARD RECORDS KEPT OF ALL COMPLETED CONNECTIONS FOR CUSTOMERS

As has been said, the information regarding all customers' connect-up work in progress except that less than one day old, is kept in the files before the girls to give information to the telephonic salesmen. When a job is finished, however, the data regarding it are transcribed on master cards. One copy is filed in the same department within easy reach of the girls, so that they may have access to information not only regarding work in progress, but regarding the installations of all of the customers of the company.

SAVING TIME FOR FIELD MEN AND SPEEDING UP SERVICE

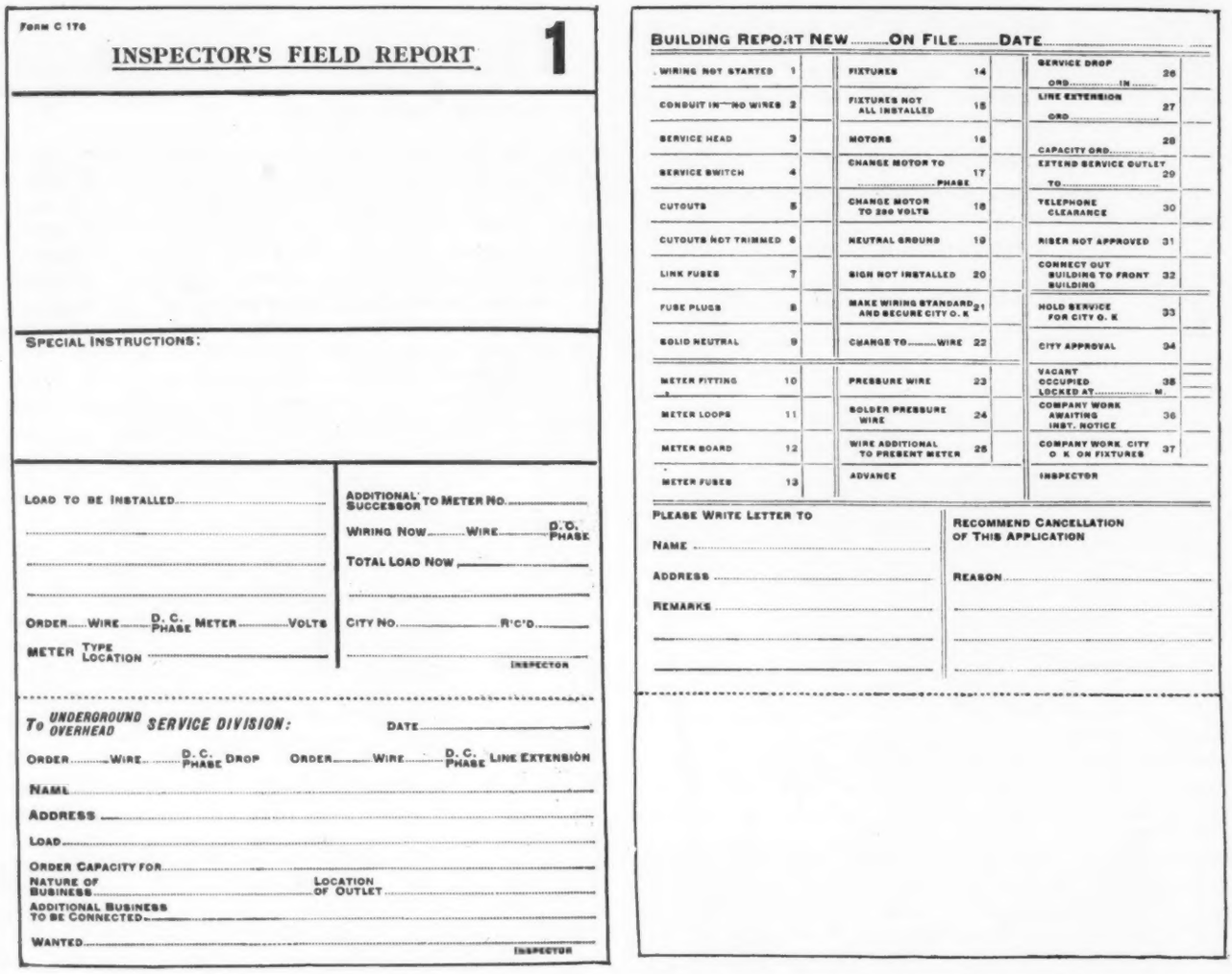
A very good illustration of the results obtained through the operation of the work-dispatcher idea can be seen in the inspection bureau. Here an analysis



THE SEMI-ANNUAL MOVING DAYS ARE REFLECTED IN THE RECORDS OF THE CONTRACT DEPARTMENT. THE BUSINESS FOR 1916 IS REPORTED TO HAVE OUTSTRIPPED ALL OTHER YEARS BY NEARLY 25 PER CENT

showed that the men formerly spent about one-third of their time in actual work, one-third in transportation and the remaining one-third in the office. Since the work-dispatcher idea has been put into effect in the inspection department the inspectors are able to devote two and a half hours more daily to actual field work; that is, to useful work.

In the inspection bureau the report form used for inspectors' reports has replaced four other forms. They are: Request for letter, cancellation, additional order and service order. Effecting this combination has increased the working efficiency of both the field and clerical organizations. Inspectors' reports are turned in each evening by the field inspectors and are sorted and sent to the overhead or underground departments



Form C 176

INSPECTOR'S FIELD REPORT **1**

SPECIAL INSTRUCTIONS:

LOAD TO BE INSTALLED.....

ORDER.....WIRE.....D. C. PHASE METER.....VOLTS

METER TYPE LOCATION.....

ADDITIONAL SUCCESSOR TO METER NO.....

WIRING NOW.....WIRE.....D. C. PHASE

TOTAL LOAD NOW.....

CITY NO.....R'C'D.....

INSPECTOR

TO UNDERGROUND OVERHEAD SERVICE DIVISION: DATE.....

ORDER.....WIRE.....D. C. PHASE DROP ORDER.....WIRE.....D. C. PHASE LINE EXTENSION

NAME.....

ADDRESS.....

LOAD.....

ORDER CAPACITY FOR.....

NATURE OF BUSINESS..... LOCATION OF OUTLET.....

ADDITIONAL BUSINESS TO BE CONNECTED.....

WANTED.....

INSPECTOR

BUILDING REPORT NEW.....ON FILE.....DATE.....

WIRING NOT STARTED	1	FIXTURES	14	SERVICE DROP ORD.....IN.....	26
CONDUIT IN—NO WIRES	2	FIXTURES NOT ALL INSTALLED	15	LINE EXTENSION ORD.....	27
SERVICE HEAD	3	MOTORS	16	CAPACITY ORD.....	28
SERVICE SWITCH	4	CHANGE MOTOR TO .....PHASE	17	EXTEND SERVICE OUTLET TO.....	29
CUTOUTS	5	CHANGE MOTOR TO 220 VOLTS	18	TELEPHONE CLEARANCE	30
CUTOUTS NOT TRIMMED	6	NEUTRAL GROUND	19	RISER NOT APPROVED	31
LINK FUSES	7	SIGN NOT INSTALLED	20	CONNECT OUT BUILDING TO FRONT BUILDING	32
FUSE PLUGS	8	MAKE WIRING STANDARD AND SECURE CITY O. K	21	HOLD SERVICE FOR CITY O. K	33
SOLID NEUTRAL	9	CHANGE TO.....WIRE	22	CITY APPROVAL	34
METER FITTING	10	PRESSURE WIRE	23	VACANT OCCUPIED LOCKED AT.....M.	35
METER LOOPS	11	SOLDER PRESSURE WIRE	24	COMPANY WORK AWAITING INST. NOTICE	36
METER BOARD	12	WIRE ADDITIONAL TO PRESENT METER	25	COMPANY WORK, CITY O. K. ON FIXTURES	37
METER FUSES	13	ADVANCE		INSPECTOR	

PLEASE WRITE LETTER TO

NAME.....

ADDRESS.....

REMARKS.....

RECOMMEND CANCELLATION OF THIS APPLICATION

REASON.....

THE TWO SIDES OF THE INSPECTOR'S FIELD-REPORT BLANK—A FORM WHICH HAS REPLACED FOUR OTHERS

that night by one man who works from 5 p. m. to 11 p. m. to speed up the work of the department. The inspectors report by telephone each day about noon, so that any additional calls which are especially urgent can be assigned to them at that time.

SOME INSPECTIONS ARE MADE WITHOUT LEAVING THE OFFICE

Another department which helps the customer to get service quickly is the clerical bureau of the distribution department. In this bureau a card record is maintained which contains accurate data on the installation in all of Chicago's apartment houses. Thus when the inspection department is notified that a prospective customer at a certain address desires service, it consults this card file and may learn therefrom that the wiring at that particular address was recently found in good condition and has not been disturbed. Knowing this to be the case, the department does not send out an inspector and thus saves the cost of inspection; allows the customer to secure service one or two days sooner, and obtains for the company that additional revenue which comes to it through the one or two days' sooner use. There are already 45,000 cards in this rapidly growing file, and all of them are cared for directly by one clerk. Each master card, as it is called, contains data regarding the number of sockets in each apartment, entrance number of the building, the number of lights in the halls and basement, the size of the meter installed, and whether there is another entrance to the building from another street.

Commercial installations and residential installations not listed in the card file are, of course, turned over to inspectors who are assigned a certain amount of work each morning, which is usually enough to keep one man busy in his territory during the day. His reports on completed inspections are turned in at night so that even in cases where installations must be inspected, service may be rendered in two days if the installation is found correct in every way by the inspector. If he finds defects in the wiring a letter is written to the owner of the property outlining the conditions which exist there.

The efforts of 297 men in the customers' service and repair department are devoted to making the company's service as continuous, reliable and convenient to use as it is easy to get. As in the applications bureau, a

twenty-position telephone board, known as the service bureau, is maintained and receives from the main switchboard all calls pertaining to trouble on the customers' premises. The operators at this board receive the customers' requests for lamps or for repairs, and fill out repair tickets which are carried to four work dispatchers by a motor-driven conveyor. The lamp requests are sorted and routed by the lamp renewal department for delivery the following day.

The work dispatchers control the operation and the movements of about seventy-five repairmen, each of whom operates in his particular district of the city. On Dec. 20, 1915, one of the busy days of the year, 2880 calls of various kinds, or more than four calls per minute, were handled by the work dispatchers of the service bureau. The average number of calls per day handled by this department throughout the year is 1950.

The repairmen are known by number. They call the work dispatcher each hour, whether they have completed the assignments given them at the end of the previous hour or not, and in this manner each repairman receives a fresh group of assignments at the end of an hour. Each repairman travels his district either in a small electric or gasoline car. The only work these repairmen do on the customers' premises is to replace fuses and make petty repairs, give customers new heating appliance cords gratis in place of worn ones, and gather defective heating appliances to be taken to the company's repair shop for free repair or part renewal.

Defective heating appliances which are gathered in by these repairmen are taken to three main sub-depots on the South Side, West Side and Northwest Side of the city. From these three sub-depots the appliances are transported to the repair shops of the company on Market Street by three 3-ton electric trucks, which make a round trip early each morning. With this system the average time which elapses from the time the customer calls on the telephone stating that some appliance is out of order until it is returned to the customer in good condition, is generally about two days. The time which elapses between the customer's telephone call and the time when the repairman arrives for the defective appliance is usually less than one hour.

Certain classes of calls, however, are considered urgent and receive immediate and special attention. Calls pertaining to washing machines are of this class, and are attended to in advance of the regular routine. Most of the troubles which these men discover are mechanical, and many of them can be fixed on the customer's premises.

$18,000 Spent for Free Repairs in 1915

But the extent to which the gratis repair work is carried on by the company may better be judged from the fact that during the year 1915 the total number of repair calls handled, exclusive of appliance calls, was 202,012, or an average of 670 per day. During the same period the total number of heating device calls was 59,351, or 297 a day. Of this number of heating device calls 37,228 required repairs of such nature that the device had to be taken to the company's repair shop. The following table shows the number of devices which were repaired free in the shops during 1915:

Flatirons	10,331
Percolators	1,448
Toasters	403
Curling irons	815
Stoves	100
Heating pads	277
Water heaters	25
Miscellaneous	353
Grills	41
Christmas tree outfits	20
Total	37,228

The fact that the work of this department is growing rapidly may be judged from the following data: During 1913 the total number of heating device calls was 28,144, whereas in 1914 it was 48,880 and during 1915 was 59,351.

Is It Worth While?

The expense to the company of operating this department and making these repairs for the customers gratis during 1915 was approximately $18,000. But when it is considered that a conservative estimate shows the irons put back in service by this method consume in the one month following about 125,000 kw.-hr.; that the percolators consume 7000 kw.-hr.; the toasters 2250 kw.-hr.; the curling irons 200 kw.-hr.; the stoves 2250 kw.-hr.; the heating pads 6 kw.-hr.; the grills 49 kw.-hr., and the miscellaneous appliances at least 45 kw.-hr., making a total of 136,854 kw.-hr., the necessity for some such system of repairs can be appreciated. For,

ONE OF THE SEVENTY-FIVE "REPAIR MEN" WHO, ON OCCASION, LOAN ELECTRIC IRONS TO WORRIED WOMEN CUSTOMERS AND OTHERWISE HELP TO MAKE EDISON SERVICE EASY TO USE

if the monthly consumption of all of these devices amounted to 136,854 kw.-hr., the annual consumption would be 1,642,248 kw.-hr., which, if considered at 4 cents per kilowatt-hour, would mean a gross income to the company of about $65,000, or about three and a half times the cost of performing the service if each appliance were repaired only once a year. It is found, however, that some customers have certain devices repaired more often than once a year. There is also a large number of calls that should not be necessary.

It will be noted that the table herewith contains no mention of vacuum cleaners, and this is attributed to the fact that manufacturers take care of the vacuum-cleaner troubles. If the repairman calls and finds a case of trouble on a vacuum cleaner that he cannot himself remedy he transmits his information to the company's central office, where it is again forwarded to the manufacturer of the cleaner. The manufacturers provide very rapid repair service on these devices.

Iron troubles are most numerous, due to the fact that there are a great many more of them being used than any other appliance. For this season each repairman is provided with one or two flatirons, which he may loan to customers at his discretion when it becomes necessary for the customer's iron to be sent to the repair shop for two days.

A Mine of Information Maintained to Speed up Service

Still another department which is well equipped to aid in rendering the customer prompt attention is the overhead service division of the distribution engineer-

ing department. Men in this department, without leaving the office, can tell the contract department or the customer himself, whether service can be given at any address within the limits of Chicago. They can also tell whether a line extension will be necessary to serve a customer at a certain location; whether the present transformer rating in that district is sufficient to permit the customer's additional load being connected, and whether or not the pole on which the present transformer is situated is large enough to carry a bigger transformer in case it is necessary to install a larger unit. All of these data are carried in an interlocking system of card and map records which cover the company's entire 60-cycle system.

Knowing that it is the company's policy to allow a certain expenditure in line extensions, per customer, this department can also readily tell the contract department approximately how much business must be obtained in a certain district to justify a line extension, since it also knows that a line extension generally costs the company about $300 a block.

Transformer Work Standardized to Promote Speed and Efficiency

The distribution engineering department also has a scheme for speeding up the process of giving service where a transformer installation is necessary. A full set of plans, comprising nine blueprints, has been worked up to show in detail every type of customers' transformer installation that the company employs. Each one of these blueprints, besides being a detailed description of the installation as it will be when completed, also carries a complete list of material needed for the job. Each one of these prints is numbered, so that they prove time-savers to the office men who order the installation, to the foremen who must carry out the work, and finally reduce the time required to provide the customer with service.

The street department has laid down an imperative rule to the effect that "every service must be completed in 2 A plus 2 days." In this rule the letter A signifies the actual time for doing the work in days. This department has several schemes for aiding itself in adhering strictly to the rule.

When jobs come to this department they are passed through the hands of a work planner, who is called the job supervisor and whose duties are to see that each job can be executed as it was originally planned by the department which originated it. This work-planner also arranges for whatever special material is needed, and he sees that all city and private-property permits and agreements with other companies have been secured before the job is given to the foreman to execute. He is, in fact, what his name implies—a man who, from a practical viewpoint, plans the work for the men who must carry it out.

Careful Routing Saves Retracing Steps

To insure efficient operation of the men who are executing the work, each of the three districts of the city is placed under a work dispatcher. Each morning this work dispatcher places colored pins in a city map before him, each pin indicating a job that must be done that day. To these various colored pins he adds enough additional pins to make a day's work, provided the "must" work is not sufficient to keep the gang going all day. With these pins in place on his particular portion of the city map, he then lays out with different colored string an economical route for each gang. Each route is laid out so that the crew can begin work in the morning near the supply depot from which it operates, and finish at night as near as possible to the depot from which it started.

Even the truck bodies which these crews use have been designed for economical and speedy handling of material. For instance, the insulators in the loaded trucks are carried on upright unthreaded pins in drawers, so that they may always be available, so that they are never covered up by other material, and so the bed of the truck is always in an orderly condition. Likewise, the wire is carried on reels instead of in loose coils, as is the usual practice.

A Red Tag That Insures the Maximum Speed in Service

Besides all these provisions for giving the customer rapid service in the ordinary course of events, there is provided a method by which a particularly important job may be given special attention. If, for instance, an engine in an isolated job should break down in such a manner that two weeks' time would be required to repair the damage, and if, in the ordinary course of events, it would require twenty-one days to provide the isolated plant owner with central station electric service, the general contract agent or any of his three lieutenants could issue a "special attention slip" for the job, which would probably insure its completion within seven days.

When a special attention slip is issued the distribution department really takes the work which the job requires through its own hands and through all other departments it must traverse by special messenger. The distribution department acts as the special agent, but the co-operation of all other departments is, of course, required for successful operation of this plan. To assure co-operation and prompt attention at every turn a glaring red tag, of which several copies are made, is attached to any matter which has bearing upon the special attention job. Such a procedure costs the company a little more to handle than ordinary routine business, but it provides a means whereby the ordinary routine may be overstepped and service provided at record-breaking speeds when such measures are really necessary. Of course, the success of this plan rests entirely upon the assumption that it shall not be abused, and therefore the authority for issuing the red slips is vested only in the general contract agent and his first lieutenants in the power and the lighting divisions.

Increase in Power Sales in Massachusetts

Massachusetts central stations sold about 210,000,000 kw.-hr. to motor users in the fiscal year 1915, compared with about 132,000,000 kw.-hr. in 1914, according to data drawn from the annual reports of the Gas and Electric Light Commission. The largest volume of power sales, 51,921,760 kw.-hr., was that of the Connecticut River Transmission Company (now the New England Power Company), the Edison Electric Illuminating Company of Boston being second, with power sales of 30,382,072 kw.-hr., and the Worcester Electric Light Company third, with 15,406,134 kw.-hr. Adding the energy sold to street railways, most of which is utilized in the operation of motors, it appears that about 250,000,000 kw.-hr. of known power business was enjoyed by the Massachusetts companies last year. About 650,000,000 kw.-hr. were generated during the year, so that in round numbers one-third of the energy delivered at the bus was utilized by power customers, and probably very nearly half the total volume of energy sold went to power users. The station load factor associated with so large a relative power business was doubtless a contributing element in the increasing efficiency of station service noted among the Massachusetts plants as a whole.

Public Demands a Square Deal for the Utility

How the People in an Idaho City Protested Against a Proposed Attack by the City Council and Told What the Company Had Done for the Community

A STRIKING example of the value of good-will to a public utility is afforded by a recent popular uprising in favor of the Lewiston-Clarkston Improvement Company, Lewiston, Idaho, when the electric rates were attacked by an engineer from without the State, who sought to bargain with the Lewiston City Council for an appeal to the Idaho Public Service Commission for a reduction in the price of energy. The engineer offered to attack the rates on the basis of a compensation of $100 for each 1 per cent reduction, with a $1,500 limit. The proposition looked attractive to the council at first and was tentatively accepted. As soon as the citizens became aware of the proposed proceedings, the community rose in opposition to the plan.

The company serves a population of about 10,800 in Lewiston, Clarkston and Asotin. Energy is supplied from a combined steam and water-power generating plant, the base rates being as follows: Residence lighting, maximum 12 cents net per kilowatt-hour, minimum charge $1.25 per month; commercial lighting, maximum net rate 11 cents per kilowatt-hour, minimum charge $1.25 per month; sign lighting, 8 cents per kilowatt-hour; window lighting, 8 cents per kilowatt-hour; maximum power rate, 9 cents per kilowatt-hour net, with maximum service charge of $1.50 per month per horsepower, the minimum energy rate being 3 cents; refrigerating rate (commercial), $6 per horsepower per month on maximum demand basis; industrial rate, 5 cents per kilowatt-hour.

When the public understood the method proposed and began to protest to the council, the company made no official appearance before that body, and did not do any advertising. From every quarter, however, defenders of its charges and policies arose, as the reward of a progressive, modern administration. A public meeting of the council was held, at which many citizens vigorously urged that the arrangement between the council and the engineer be rescinded.

The grounds for this protest included the following points: That an investigation of rates at the time was ill-advised, particularly when the offer to reduce them came from an outside party for a contingent fee; that the corporation which was the object of attack was a home institution, and that any person was privileged to bring its business before the Public Service Commission, and that the company had supported not only light and power, but community development. Several speakers commended the work of Robert A. Foster, president and general manager of the company, instancing the public-spirited policies maintained and picturing the benefit conferred upon the community by the development of its electrical facilities by the Adams interests of Boston.

PRAISE FOR THE COMPANY

One speaker said that the people felt most friendly toward the company, and were justified in this attitude because of the expense attached to the development, repairs to ditch lines, flumes, auxiliary plant and other improvements; that the company was entitled to every lift the people could give it. It was pointed out that two voluntary reductions in rates had already been made by the company in Asotin, and it was argued that when the time was ripe for a further decrease the company itself would bring this about. "Beware of Greeks bearing gifts," said one defender of the company. Another opponent to a rate investigation urged that the interests of the company and of the community were the same, and pointed out that the present management was eminently fair, taking into consideration every complaint and weighing it with care.

Addressing the council, another speaker said: "Be fair with capital, and the moment a corporation gets on a paying basis, do not strike it down." A representative of a delegation of citizens from Lewiston Orchards said that he was cognizant of the trying period through which large corporations are now passing, including the local light and power company, and asked the council to reconsider its action. An outlay of $5,000 by the company for a line extension to this section was instanced, emphasis being laid upon the fact that years must pass before a profit could be realized from this branch of the distribution system.

The point was also made that outside capital is needed in the development of Idaho, but that it cannot be secured if it is to be hampered at every turn. It was stated that in the past year the company had expended approximately $17,000 more in improvements than it took in. The proprietor of a large cold-storage market and a substantial consumer of energy announced himself as decidedly opposed to any action to reduce rates, considering those in force as equitable. By a vote of five to one the council then killed the proposed investigation.

HOW TO ATTRACT CAPITAL

Editorial comment in the local and other Northwestern papers of general circulation strongly commended the attitude of the public and the willingness of the council to rescind the investigation program, and emphasized the broader aspects of the case in relation to the development of the State. The Lewiston *Tribune* in its discussion of the subject said: "The surplus money of this country is not being employed in the great work of development as heretofore. Much of it is lying in the banks idle. Why? Is it the highly-successful corporation baiters in the politics of the country who are chiefly responsible for this loss of confidence by which thousands of wage-earners are left without employment? . . . In some parts of the country development has come to a standstill. . . . There are doubtless some of this old school of merciless exploiters still alive and busy in spite of all the regulation, prosecution and penalizing that have been going on. But it is generally conceded and is quite well known that there is much less of this thing than formerly, and that the industrial world is to-day upon at least as honest a basis as other lines of human interest and contention.

"Unless something can be done to strengthen the confidence of the owners of money now deposited in the banks, they are not going to invest in railways, utility corporations or other enterprises that are being so fiercely regulated, so continually threatened, so often denied even reasonable protection of property, so mercilessly kicked about in politics, and so abused and raided by many of the people who have their prejudices as well as their cupidity aroused against them. As long as the owners of the money are left to suspect or even to fear that all their profits and even more than that may be

taken from them in defending lawsuits, paying taxes, penalties, damages and in reduction of rates, of course they are not going to take the risk, in addition to the usual and necessary risk of the undertaking."

Under the caption "A Blow to the Ambulance Chaser," the Idaho *Statesman*, Boise, pointed out the unique distinction of Lewiston, whose people "have set an example, not only for Idaho but for the entire Northwest, all of which is still in the constructive stage—still in the making. This example has two angles. One runs to a broad public policy of according fair treatment to public utilities, encouraging them to branch out and to aid in upbuilding the districts in which they operate instead of harassing them through official channels, curtailing the revenue they need for extensions and improvements, and forcing them to the door of bankruptcy, if not shoving them through. The other angle carries us to what is known as the 'ambulance chaser.' . . . The industrial ambulance chaser is equally pernicious in his activity. For profit, for political prestige or for other reasons he is ever present, encouraging thoughtless organizations and a public that he too often finds gullible to bitter antagonisms against corporations that have in good faith invested in the community, whose interests are identical with that of the community. . . . If the policy adopted by the people of Lewiston had been adopted by all the people of Idaho, the resources of this State would have been developed to a far greater extent."

Fair Treatment Required

Commenting upon "A Square Deal to Capital," the Portland *Oregonian* pointed out that the reasons for hostility to public utility corporations have practically been done away with by public regulation; that direct legislation in the Pacific States has made corporations powerless in politics except so far as they, with other citizens, appeal openly to the people's reason and sense of justice. "The public interest requires fair treatment, for the operations of corporations are the only practicable means by which large enterprises for the development of the country can be carried out. If by being denied adequate rates or by excessive taxation, corporations are prevented from earning a fair profit, capitalists will not buy their securities, will invest their money elsewhere, and development of the country will be prevented or seriously retarded. It is high time that the people of Oregon as well as other Pacific States changed their attitude toward corporations to accord with the changed attitude of corporations toward them. Prosperity in the East is creating a vast supply of new capital. It will come here if we turn a deaf ear to schemers like the man who made the proposition to Lewiston. The anti-corporation cry will soon die if the politicians find it is unpopular. . . . Let us silence the demagogue and invite capital to come in by giving it a square deal."

Replying to an inquiry by the Electrical World, Mr. Foster states: "We subscribe to everything which our citizens attempt to do as a local undertaking, and give our time freely, believing that in helping to build up our community we are only helping ourselves. I have made it a practice to meet and know nearly everyone, and give personal attention to complaints, which if allowed to fester might make trouble in the future. At our counters we have men who have the ability and disposition to meet the public cordially, and it is an unwritten law that no customer shall go away dissatisfied if there is any reasonable chance to adjust whatever difference there may be. We are now attempting to make a development which not only will build a considerable city at this point, but will greatly enlarge the activity of this particular company."

PRECAUTIONS WHEN USING COPPER SUBSTITUTES

German Engineers Discover and Define Limitations to the Use of Zinc Wire for Overhead and Underground Circuits

It has been found by German engineers that bare zinc wires or cables are not suitable for overhead lines for the reasons outlined in an article in the Electrical World of April 29, 1916. The main reason given is its mechanical weakness and liability to breakage under atmospheric influence. As a substitute for copper in overhead lines only iron is now considered. German experience has, however, indicated that in general rubber-insulated zinc conductors as well as jacketed wire can be used in the same way and installed in the same manner as in the case of insulated copper conductors. When binding zinc wire into eyes, however, some care is necessary, and in particular it is unwise to bend the zinc wire around the sharp edge of tools having a small radius of curvature. Neither should it be subjected to unnecessary pull. The soldering of zinc wire requires particular care on account of the low temperature of fusion. It is best to avoid it as far as possible and make all connections by binding posts or screws. Experience indicates the importance of using constructions which prevent the escaping of single wire strands, as in bushing and slot contacts. Zinc-wire fittings and accessories do not differ from those used with copper.

The precautions to be observed in laying copper cables with paper insulation, as regards the paper, apply equally to zinc cables. It is undesirable for the radius of curvature to be less than twenty-five times the cable diameter. If cables are laid in cold weather, they must first be warmed in a suitable manner, and cables which have been laid should not be moved nor subjected to any mechanical strain during cold weather. In making joints it is necessary to avoid the heating of the filler much beyond 100 deg. C. Warming the zinc conductor with the soldering lamp is not permissible. Binding screws need not be of zinc, since when the cable sleeves are properly protected from moisture no electrolytic action need be feared. Contact points of zinc with other metals exposed to either direct moisture or to damp air must be protected by a coat of shellac or paint, and this should be observed in connecting rubber-insulated zinc conductors with copper or brass binders.

As regards loading, the increase in temperature of the conductor should not be allowed to exceed 25 deg. C. In general, zinc cable may be given for the same temperature increase about one-half the current loading of copper cable of the same cross-section. The current required for fusing the conductor metal is somewhat higher for zinc cables in spite of the lower fusion point (412 deg. C. against 1084 deg. C. for copper) because of the greater mass of metal. As a light arc is more easily interrupted with zinc than with copper, there is little danger that in case of a short-circuit a longer section of zinc cable would be rendered useless. For heavy current it is desirable to use no zinc cable of less than 16 sq. mm. cross-section, and for this cross-section stranded conductors should be employed for mechanical strength. Test wires should be avoided in zinc cable because individual zinc wires are likely to tear under excessive mechanical strain, while the insertion of iron or copper wires renders electrolytic phenomena possible.

The electrical characteristics of zinc conductors and their use for busbars, to replace copper in electrical machines and for house wiring installations, were presented in the article to which reference has already been made.

Lighting Industry Maintains Large Growth

April Earnings from Sales of Energy for Light and Power Total $33,100,000—Output for the Month of April Was 1,778,000,000 Kw.-Hr.

REFLECTING the general prosperity of the United States the electric light and power industry continues to show at the end of each month a more than substantial increase in earnings and output in comparison with the figures for the corresponding month a year ago. According to statistics received and compiled by the ELECTRICAL WORLD, the increase in gross revenue from light and power sales during April last, as compared with April, 1915, was approximately $4,500,000. For the month of April, 1916, the gross revenue was $33,100,000 and the output was 1,778,000,000 kw.-hr. The increase in output over April of last year was 340,000,000 kw.-hr., or 23.6 per cent. This increase in output is equal to the combined monthly output of California, Oregon, Washington, Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah and Nevada.

During the first four months of 1916 the earnings totaled up to $140,000,000 against $121,400,000 for the first four months of 1915. Should the earnings keep up at this rate the 1916 totals will be well over the $400,000,000 mark.

Percentages of increase were less in April than in preceding months. Both earnings and output are fall-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1915	1914	Per Cent Increase	1915	1914	Per Cent Increase
May	65	17,644,205	16,764,546	5.3	920,895,324	842,386,583	9.3
June	65	17,603,614	16,476,255	6.9	925,067,308	836,292,076	10.6
July	64	18,488,793	17,200,827	7.5	971,699,054	880,768,487	10.4
August	64	17,342,796	16,024,893	8.2	951,752,053	853,381,696	11.3
Sept	65	18,547,170	17,074,927	8.6	1,003,606,094	871,573,412	15.1
Oct	65	20,112,813	18,329,490	9.8	1,087,786,658	949,288,459	14.7
Nov	65	21,899,048	19,720,232	11.6	1,150,669,073	948,704,941	21.3
Dec	64	23,418,774	20,962,264	11.8	1,230,655,404	1,004,108,399	22.5
		1916	1915		1916	1915	
Jan	65	25,286,336	22,352,721	13.2	1,200,672,452	984,205,683	22.0
Feb	65	22,133,485	19,175,537	15.3	1,121,452,738	869,537,132	29.1
March	65	22,022,649	18,718,065	17.8	1,212,289,695	969,820,893	25.1
April	64	21,183,400	18,353,840	15.4	1,137,148,698	919,996,711	23.6

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	Apr.
INCOME:										
Group 1	5.3	7.2	7.3	8.7	9.8	10.2	10.7	14.1	16.0	13.9
Group 2	8.8	9.1	10.0	11.4	12.8	13.8	21.3	20.0	18.5	17.0
Group 3	9.7	14.5	15.4	23.4	18.0	19.8	18.3	20.7	28.1	24.7
Group 4	8.2	8.0	9.0	8.7	11.9	13.6	13.1	15.7	19.9	17.3
Group 5	8.5	7.5	11.9	5.7	13.0	13.0	7.2	18.5	26.5	17.1
OUTPUT:										
Group 1	11.1	9.7	12.2	10.7	17.0	19.0	19.0	25.4	22.0	20.0
Group 2	18.1	19.0	18.9	21.4	29.0	31.5	28.0	40.6	28.1	25.5
Group 3	4.5	13.0	24.0	27.3	36.0	33.0	33.2	39.6	39.0	37.7
Group 4	12.5	10.9	11.3	13.4	18.0	16.3	22.6	29.7	18.0	22.5
Group 5	20.5	12.7	19.3	1.7	13.4	9.7	8.5	22.4	29.9	33.5

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April
INCOME:										
Group 1	11.2	11.0	10.6	12.7	13.8	14.8	16.5	18.0	21.5	16.0
Group 2	7.0	9.6	10.3	12.6	12.7	16.1	15.4	19.9	19.0	21.2
Group 3	10.2	16.5	14.7	17.3	15.5	22.8	22.1	29.7	38.7	15.5
Group 4	6.6	9.2	10.0	8.8	9.0	9.6	11.3	15.1	18.1	13.2
Group 5	16.0	21.2	5.8	8.3	13.7	23.5	20.6	26.3	54.5	27.6
OUTPUT:										
Group 1	17.2	17.2	19.2	20.8	28.7	26.2	29.0	38.5	30.9	25.0
Group 2	26.0	26.0	21.7	18.3	30.0	26.5	26.0	36.8	27.8	31.4
Group 3	13.5	12.3	14.4	8.7	23.0	22.5	39.5	41.6	49.0	38.1
Group 4	7.8	13.6	9.0	20.6	20.1	18.5	15.0	23.0	17.4	36.1
Group 5	11.0	15.1	8.5	1.8	51.0	14.5	22.6	25.6	58.7	71.8

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1915	1914	Per Cent Increase		1915	1914	Per Cent Increase		1915	1914	Per Cent Increase		1915	1914	Per Cent Increase
INCOME	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,946,907	4,577,818	8.1	88	3,383,749	3,233,989	4.8
	June	67	2,063,423	1,874,575	10.2	69	6,945,986	6,628,523	4.8	57	4,993,410	4,492,411	11.2	88	3,409,738	3,281,696	3.9
	July	66	2,020,513	1,835,968	10.2	68	6,710,217	6,519,442	2.9	56	4,801,699	4,211,641	13.9	88	3,539,168	3,317,713	6.8
	August	63	2,057,635	1,855,140	11.0	68	6,853,118	6,511,307	5.3	56	4,749,082	4,231,322	12.2	88	3,545,454	3,288,729	7.8
	September	66	2,162,064	1,949,663	11.0	68	7,288,842	6,904,245	5.5	57	5,285,358	4,891,751	12.6	88	3,664,215	3,387,717	8.2
	October	66	2,327,214	2,073,059	12.3	68	8,096,982	7,550,808	7.2	57	5,820,653	5,153,314	13.0	88	3,798,012	3,477,051	9.3
	November	66	2,472,539	2,188,049	13.0	67	8,894,805	8,158,589	9.0	57	6,342,582	5,554,226	14.2	88	4,069,995	3,703,124	10.0
	December	66	2,817,557	2,448,813	15.0	67	9,335,396	8,529,866	9.4	57	6,983,909	6,063,349	15.1	88	4,150,045	3,773,810	10.0
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	66	2,819,144	2,432,177	15.0	67	9,589,347	8,564,488	12.0	57	7,834,831	6,717,799	16.6	88	4,182,114	3,823,156	9.4
	February	66	2,599,760	2,185,967	18.8	67	8,978,797	7,854,345	14.3	57	6,660,062	5,568,337	19.7	88	3,761,364	3,443,182	9.3
	March	66	2,595,777	2,122,177	22.0	67	8,993,984	7,655,990	17.5	57	6,470,612	5,394,250	20.1	88	3,787,925	3,386,286	11.9
	April	64	2,221,544	1,898,749	17.0	66	8,775,743	7,581,279	15.8	56	6,289,092	5,292,974	19.0	88	3,820,468	3,514,495	8.8
KW.-HR. OUTPUT	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	262,885,043	236,154,464	11.2	88	254,586,394	236,082,868	7.8
	June	67	71,566,127	60,972,379	17.4	69	318,245,370	293,751,083	8.5	57	265,930,311	234,286,440	13.2	88	261,083,935	237,843,021	9.8
	July	66	71,025,184	60,755,381	17.0	68	320,371,761	293,909,832	9.0	56	264,498,989	232,541,585	13.9	88	274,488,934	258,475,004	6.3
	August	63	71,954,506	60,870,433	18.5	68	329,947,721	302,960,234	8.9	56	272,508,518	240,423,753	13.4	88	276,631,551	248,463,980	11.3
	September	66	74,835,203	63,716,224	17.3	68	358,765,971	319,549,780	12.3	57	286,893,057	247,046,941	16.1	88	279,133,989	237,795,633	17.5
	October	66	82,568,951	69,882,867	18.3	68	400,516,741	353,685,472	13.3	57	305,962,017	268,972,416	13.7	88	292,885,623	251,095,356	16.8
	November	66	87,193,883	69,359,620	25.8	67	420,584,253	355,151,259	18.5	57	333,528,905	269,870,536	23.7	88	301,772,412	248,913,893	21.0
	December	66	99,744,195	80,446,521	24.1	67	447,158,465	373,213,316	20.0	57	363,859,444	293,266,707	24.1	88	311,034,100	249,996,678	24.5
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	66	97,072,794	77,029,974	26.2	67	431,201,554	356,809,437	20.8	57	362,121,067	284,407,361	27.5	88	301,645,060	258,982,414	16.5
	February	66	92,855,679	68,982,535	34.8	67	411,715,612	320,924,478	28.1	57	339,326,360	252,816,291	34.1	88	268,653,564	220,662,826	22.1
	March	66	97,321,924	74,958,898	29.9	67	439,587,380	349,280,098	26.0	57	360,872,072	282,179,673	28	88	304,327,753	255,450,143	19.3
	April	64	84,769,660	64,816,830	30.8	66	402,827,237	326,233,434	23.5	56	344,866,175	273,367,413	26.4	88	302,327,834	253,651,010	19.2

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April
INCOME:										
Group 1.....	1.4	4.0	4.4	6.2	7.6	8.3	11.1	13.7	16.7	15.1
Group 2.....	9.7	11.6	11.0	11.9	15.0	14.0	18.2	18.4	21.2	18.5
Group 3.....	7.5	8.5	8.9	11.0	10.0	13.1	11.9	14.6	20.5	15.3
Group 4.....	7.0	8.4	10.0	9.8	14.4	15.3	17.4	19.4	18.0	20.0
Group 5.....	†	2.0*	14.3	10.9	14.6	12.2	16.0	15.8	12.2	15.6
OUTPUT:										
Group 1.....	8.0	9.0	11.6	12.1	16.0	20.1	21.1	30.8	29.2	26.1
Group 2.....	17.0	15.0	16.3	16.8	26.6	25.5	26.4	33.4	25.6	35.6
Group 3.....	7.5	6.4	10.4	15.8	22.1	16.6	20.1	22.0	16.0	13.7
Group 4.....	13.8	13.2	12.5	14.8	22.0	18.9	15.6	21.8	20.8	19.2
Group 5.....	†	11.4	13.8	2.8*	18.6	20.6	1.5	24.0	13.1	8.9

*Decrease. †Results omitted owing to insufficient returns.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April
INCOME:										
Group 1.....	11.8	12.2	12.4	12.3	17.0	15.8	14.3	18.3	19.3	18.2
Group 2.....	7.0	7.5	8.6	10.2	10.8	9.8	25.5	20.5	19.1	18.0
Group 3.....	16.4	21.0	22.0	22.7	24.0	25.1	24.3	27.0	23.0	26.7
Group 4.....	13.0	16.9	17.9	16.0	19.8	18.3	9.6	20.2	22.9	22.8
Group 5.....	1.2	20.2	13.5	24.7	9.6	18.0	5.7	11.1	14.4	9.4
OUTPUT:										
Group 1.....	11.8	12.2	15.2	10.4	22.0	21.9	24.9	30.3	25.2	24.7
Group 2.....	11.1	9.8	9.0	14.0	21.5	31.0	28.8	44.0	32.3	23.9
Group 3.....	28.9	31.0	29.3	34.2	43.0	41.2	32.5	44.0	40.6	43.5
Group 4.....	18.2	26.1	29.0	33.5	36.7	18.5	53.4	41.0	31.9	39.2
Group 5.....	24.9	25.1	48.0	3.0	17.3	20.6	13.3	15.9	19.1	10.1

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb	Mch.	April
INCOME:										
Group 1.....	5.1	7.0	13.9	7.5	7.5	6.0	11.6	6.7	8.5	3.9
Group 2.....	13.0	11.1	11.5	14.3	15.7	17.3	†	†	18.7	3.5*
Group 3.....	7.9	17.1	19.7	21.4	20.0	24.6	19.7	22.0	28.1	40.0
Group 4.....	7.8	0.2	0.3	0.1	4.3	10.8	3.0	8.2	17.5	11.7
Group 5.....	4.5	1.7*	15.0	3.1	13.5	3.9	10.5	17.8	26.3	14.2
OUTPUT:										
Group 1.....	6.2	6.3	8.4	7.1	9.9	13.1	9.1	13.0	22.7	8.0
Group 2.....	27.5	39.3	40.3	41.3	51.0	56.0	†	†	28.3	3.6*
Group 3.....	8.4*	18.5	49.2	52.4	67.0	67.0	56.0	68.8	39.0	80.0
Group 4.....	11.8	0.2	4.1	1.5	6.2	10.5	1.8	13.8	18.6	10.3
Group 5.....	10.9	8.0	21.0	3.5	8.3	1.0	1.0	20.1	30.0	16.3

*Decrease. †Results omitted owing to insufficient returns.

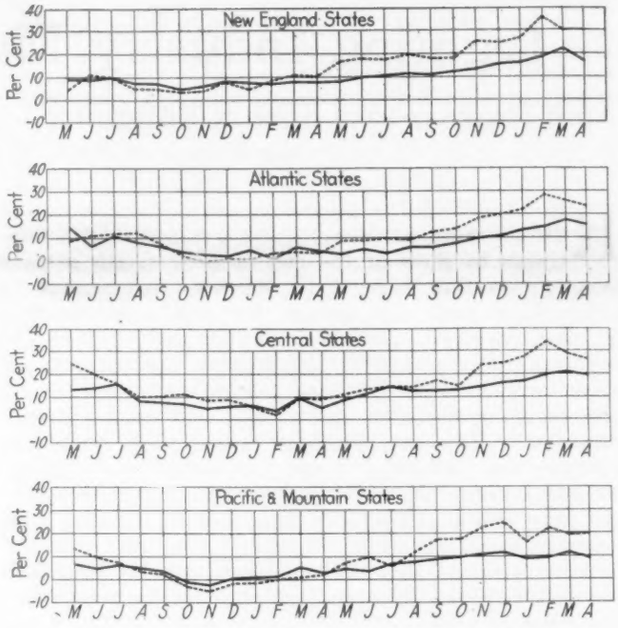
ing off in totals, but this, of course, is for seasonable reasons. Longer days make for smaller lighting bills.

INCREASING DEMAND FOR POWER

Letters received from a large number of the properties represented in these statistics show a general increasing demand throughout the country for light and power service—particularly the latter. The second half of 1914 and the early part of 1915 were marked by a very severe industrial depression. Since that time it has practically fallen to the lot of American industries to supply the world's markets with their needs. Not only did the central stations benefit to the extent of the increased demand of those already on their lines, but so great was the demand for power from others that it was with difficulty that they were supplied. The difficulty has been principally in the manufacture of motors, of which it was almost impossible to get quick deliveries.

Reports from the New England States give the industrial revival, which started in that section about June, 1915, as the predominating reason for the large increases that have been reported from this section. A new munition factory in Connecticut accounted for a certain amount of the increased load.

Increased power load was responsible in the Atlantic States for the better conditions which became manifest



FIGS. 1 TO 4—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

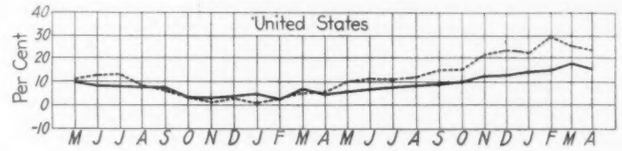


FIG. 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

about the last quarter of 1915. In the Middle Atlantic States considerably less than half of the increased load could be traced to war business. In the South Atlantic States the general good business and increased power sales bolstered up the figures for this territory.

Both lighting and power sales showed large increases in the Central States. One prominent company in Minnesota stated "our increase is largely due to the increased number of meters to residence customers. We find that the domestic consumption of electricity is growing rapidly." Where there are large iron and steel mills or where there is zinc mining the increase in output is tremendous. It is pointed out that while in the forepart of 1915 business was running way below capacity that in the early months of the present year almost every factory was working to its limit.

In the Far West, which section probably suffered the most from the depression brought on by the war in Europe, the better showing made by the light and power companies was attributable, aside from the normal growth, to the revival in the mining and oil well industries. In some instances rate reductions made unmistakable impressions on the earnings.

EXPLANATION OF TABLES

The accompanying curves show graphically the percentage of increases in income and output over a period of months as contained in Tables I and II. The remaining tables show the percentages of increase in income and output by sections in which the companies are grouped according to the size of the communities served. Group 1 includes those companies operating in cities with populations in excess of 100,000; group 2 in cities of 50,000 to 100,000 inhabitants; group 3 between 25,000 to 50,000; group 4 between 10,000 and 25,000, and group 5 between 5000 and 10,000.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COST OF OPERATING A KANSAS PUMPING PLANT

Facilities Provided by Fredonia (Kan.) Water Works for Operating Motor-Driven Pumps Continuously—Itemized Cost of Operation

BY O. H. HORNER

Obsolete steam equipment has been abandoned at Fredonia, Kan., in favor of electrically-driven machinery to pump 300,000 gal. of water consumed daily. The abandoned plant has been operated for thirty years to lift water from Fall River to a large masonry reservoir 150 ft. above the city.

PUMPING ARRANGEMENTS

The new plant, which was put in operation on Feb. 1 of this year, adds a purification plant to the city's water works. As before, water is lifted from Fall River, but is first delivered to coagulating and settling basins by two 700-gal. per minute vertical centrifugal pumps, each driven by a 10-hp. vertical 220-volt, three-phase, 60-cycle slip-ring motor. From the clear-water well the filtered water is pumped up into the masonry reservoir, formerly used as a settling basin, by two 700-gal. per minute double-acting triplex pumps. Each pump is driven through a double-speed reducing gear by a 65-hp., three-phase, 60-cycle, 2300-volt polar-wound Westinghouse induction motor. Used in connection with the filter equipment is an air blower which is driven by a 15-hp., 220-volt, three-phase, slip-ring motor. The same rating was chosen for both the centrifugal and triplex pumps, so that when both are operating the water level in the intermediate settling basin will not vary perceptibly. Furthermore, by pumping continuously it is possible to maintain a practically constant water level

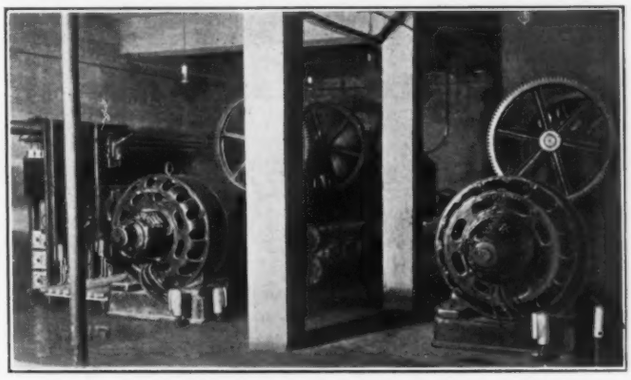


FIG. 1—POLAR-WOUND INDUCTION MOTORS GEAR CONNECTED TO TRIPLEX PUMPS

in the main reservoir. The latter is a masonry structure with a capacity of about 200,000 gal. per foot depth, and a total capacity of 1,750,000 gal. This equipment and pumping arrangement eliminates the necessity for automatic devices to maintain the water at any fixed level in the storage reservoir. The pumps are started and stopped manually, running usually from 7 a. m. for a period of from six to nine hours daily, depending largely on the season of the year.

HYDROELECTRIC PLANT FURNISHES PART OF POWER

Since the pumping station is situated on the site formerly occupied by a water-driven flour mill, advantage was taken of the hydraulic facilities remaining. The old masonry dam was repaired and resurfaced with

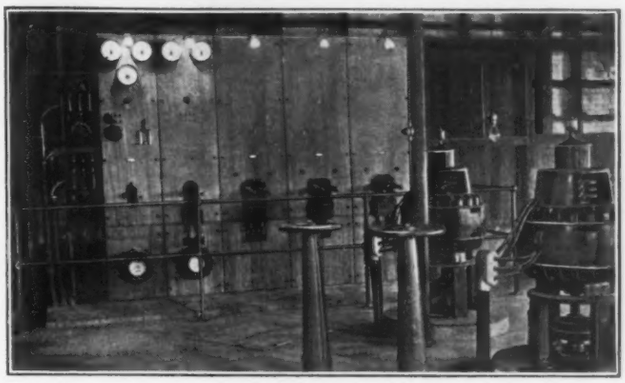


FIG. 2—VERTICAL SLIP-RING MOTORS DRIVING 700-GAL-PER-MIN. CENTRIFUGAL PUMPS

concrete, while the old waterwheel was replaced by a 90-hp. vertical water turbine, which is belt-connected to a 75-kw., three-phase, 60-cycle, 2300-volt generator. This equipment furnishes adequate power for operating the pumping plant during a part of the year. Additional energy may be obtained from a 2-mile, 2300-volt transmission line of the Fredonia Light & Ice Company. Purchased power will be used, however, only when water power is not available, that is, during low water, or when the hydroelectric plant is rendered useless by high water. The electric service company furnishes energy at 2.5 cents per kilowatt-hour when it is taken during off-peak periods. Operating under the above-mentioned conditions the cost of pumping is approximately as follows:

ITEMIZED EXPENSES INCURRED IN SUPPLYING ELECTRICALLY PUMPED WATER AT FREDONIA, KANSAS

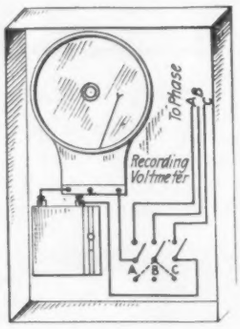
Energy Expenses		Cents per 1000 Gal.
Purchased power for pumping against:		
25-ft. head at 50 per cent efficiency		0.392
210-ft. head at 75 per cent efficiency		2.2
Total		2.592
Generated power:		
Interest and depreciation (10 per cent of $6,000 investment)	$600	
[1]Miscellaneous operating expenses	150	
Total	$750	
[2]Energy developable (kilowatt-hours)	72,000	
Cost per kilowatt-hour (cents)	1.042	
Cost per 1000 gal. (cents)		1.079
Average cost per 1000 gal. (using half generated and half purchased power)		1.835
Pump House Expenses		
[3]Labor and superintendence	$2,040	1.950
Interest and depreciation (9 per cent on $29,000)	2,610	2.785
Oil, waste, etc.	300	
Alum for coagulation (at 1 cent per 1000 gal.)		1.000
Total cost of delivering water to reservoir		7.570

[1]Labor is not included here but is under pump-house expenses.
[2]Based on assumption that 50 kw. can be developed six months of year.
[3]Only one operator is required.

A Scheme for Determining Unbalancing on Three-Phase Circuits

BY GEORGE W. TEFFEAU, JR.

The equipment shown in the accompanying sketch was devised to facilitate the making of voltage records on the distribution circuits of the Southern California Edison Company. It consists of a 110-volt or 220-volt recording voltmeter, and three small single-pole double-throw knife-blade switches mounted in a weather-proof box. The box is mounted on a pole close to a bank of transformers located as near as possible to the point where perfect regulation is required, and the leads from each phase of the secondaries run down the pole in iron pipe to the switches in the box. If the transformers are connected for power service a 220-volt meter is used; if for lighting and power a 110-volt meter is used.



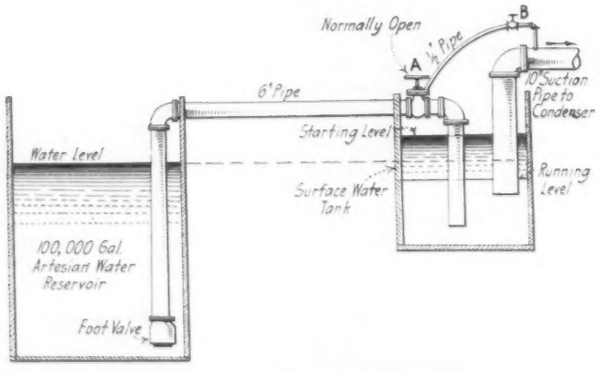
DEVICE FOR RECORDING PHASE VOLTAGES OF DISTRIBUTION CIRCUITS

With switches *A* and *B* up and *C* down the voltage recorder is for phase *AB*; with switches *A* and *C* up and *B* down the voltage is for phase *AC*; and with switches *B* and *C* up and *A* down the voltage is for phase *BC*.

With the arrangement of switches shown in the sketch any combination of voltages can be secured. It is thus possible to detect any unbalancing, since records can be secured for the different phases each day.

Scheme for Automatically Supplying Reserve Water to Condenser Intake Tank

To supplement the supply of surface water for condenser use, which is not always adequate for the requirements, a scheme has been worked out by W. E. Reynolds, superintendent of the municipal electric light plant of Dowagiac, Mich., for automatically taking water from an artesian well. As shown in the accompanying drawing, a 6-in. pipe has been installed as a syphon connecting the artesian well reservoir and the surface water tank. The valve *A* is arranged to cut off the artesian water supply if desired. A ½-in. pipe is tapped into the top of the valve *A* housing and into the 10-in. suction pipe from the condenser pump, and a valve, *B*, inserted in this pipe also.



A SYPHON ARRANGED TO MAINTAIN SUFFICIENT WATER IN ONE OF TWO CONDENSER INTAKE RESERVOIRS

The condenser creates a suction on the 10-in. pipe and the ½-in. pipe exhausts the air from the 6-in. pipe to the artesian well. When the level of water in the surface water tank is brought down to a lower level than that of the water in the artesian reservoir, the latter syphons over and supplies the surplus water needed. A check valve in the 6-in. pipe prevents the surface water from syphoning back into the artesian reservoir from the surface water tank.

Grounding Strain Insulator Supports to Prevent Burning Cross-Arms when Insulators Fail

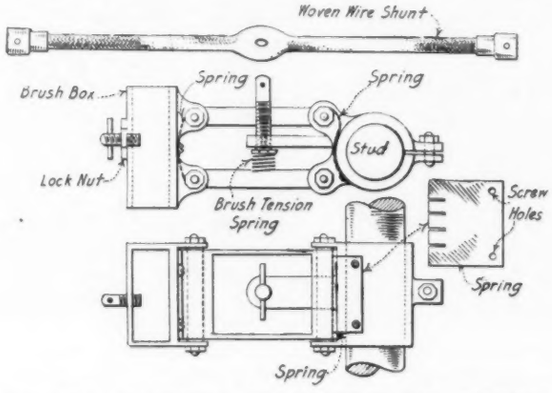
In making transmission line repairs at points where strain insulators have broken down on overhead crossings at Oak Park, Ill., on one of the properties of the Public Service Company of Northern Illinois, line foreman E. B. Spencer has observed that the cross-arms are burned where I-bolts supporting strain insulators pass through the arms. Since the arms would not have been burned if the I-bolts had been grounded, at his suggestion the company has adopted the practice of grounding all I-bolts supporting strain insulators at points where the same or adjacent cross-arms carry grounded insulator pins.

How a Brush-Holder Trouble Was Traced to Contact Springs and Remedied by Flexible Shunt

R. L. HEARVEY

A case has recently been called to the writer's attention where the brush-holders on several generators started to discolor and heat. The holder was of the parallel motion type, as shown in the accompanying sketch. To prevent the burning of the hinge joints of the parallel motion, phosphorus bronze springs 0.010 in. thick were used to carry the current around these points. As long as the contact between these thin springs and the moving arms was perfect no trouble occurred. But as soon as any part of the contact became defective an overload was thrown on the remaining contacts, causing overheating. The total contact area of the springs on the holders of the same polarity was 0.360 sq. in. for 250 amp. A properly designed contact to carry this amount of current should have 1¾ sq. in. of surface.

To relieve the trouble, the springs were taken out and replaced with a flexible shunt, as shown in the sketch.



SUBSTITUTION OF WOVEN WIRE SHUNT FOR SPRINGS OF PARALLEL MOTION BRUSH-HOLDER

In such a case it should be mentioned that unless the soldering of the flexible wire into the lug is very carefully done the solder will get into the wire and stiffen it. In order to prevent this, the shanks of the lugs were flattened with the wire in it, forming a very strong electrical joint. The box type of construction of this holder afforded a substantial contact between the holder

and the brush. Due to the weight of moving box and its supporting arms, however, this type of brush-holder is being displaced by a stationary holder and sliding brush with a light spring. With a high commutator speed the heavy brush and holder cannot follow the irregularities of the commutator, as well as the lighter brush. The brush that can move in its holder is better able to follow the grooves in the commutator as the armature weaves backward and forward in the bearings. Although the brush-holder is usually considered a minor part of the motor or generator, it has held the attention of the designing engineer for a good many years and still needs attention by operators.

Installation of Cables and Control Switches for Motors Operating Bascule Bridge Over Ship Canal

BY J. G. KOPPEL

Continuity of service was one of the chief requirements which was considered in furnishing electric service for operating the bascule bridge over the Sault Ste. Marie ship canal, since through this waterway thousands of tons of coal, copper, iron ore and grain must pass every year. Owing to the very high clearances

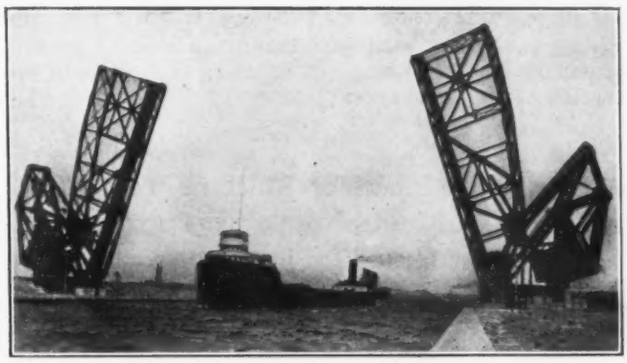


FIG. 1—MOTOR-OPERATED BASCULE BRIDGE OVER SAULT STE. MARIE SHIP CANAL WITH OPERATOR'S TOWER AT RIGHT

required by the government over deep waterways, it was decided advisable to deliver energy to the north leaf of the bridge through submarine cables. At first it was intended to lay armored cables on the bottom of the canal, but because of the possibility of damage from drags, it was decided to inclose the conductors in conduits and lay them below the canal-bed surface. For further assurance of uninterrupted service, duplicate circuits were provided for both power and control purposes, and each pair of the two sets inclosed in separate conduit cable, so that each power cable and its corresponding control would be together. Provisions were also made at each end of the cables to isolate any circuit.

Two cables containing nine No. 2 conductors were provided for motor circuits, and an equal number of cables containing fifteen No. 12 conductors were installed to operate the indicators and brakes and for signaling purposes. Each conductor was stranded and paper insulated, and the cable protected with a lead sheath. Six-inch cast-iron conduits were employed to furnish additional protection to each power cable and its corresponding control cable.

Two sets of double-throw switches, one for the power circuits and one for the control circuits, were installed in special terminal boxes at each end of the cables so that either of the duplicate circuits can be employed, thus leaving one set for emergency service. The blades of the control switches, as shown in Fig. 2, were all connected to one handle so that they can be shifted simultaneously. The power circuits, however, are controlled individually by independent switches. Barriers are provided between the switch blades, which are about 5 in. apart, to prevent accidental cross contact. Each set of switches is attached to its individual slate panel mounted 4 in. from the back of the panel box, space being pro-

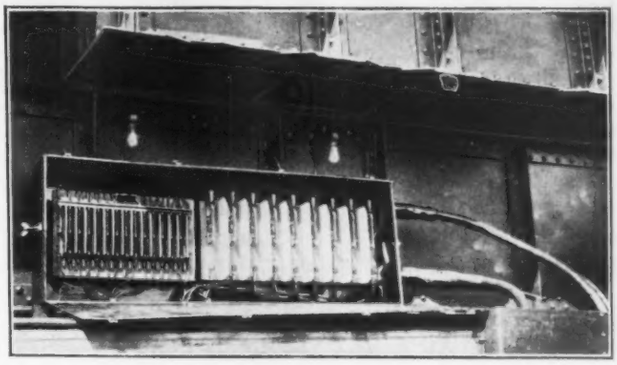


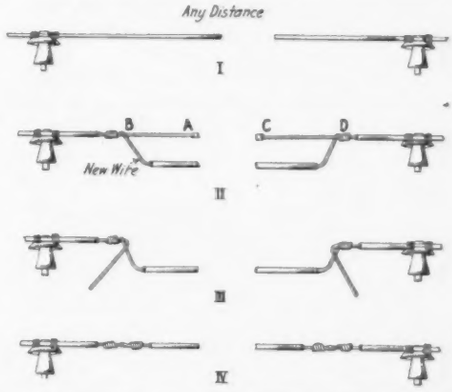
FIG. 2—CABLE-TERMINAL AND SWITCH CABINET ON SHIP-CANAL BRIDGE

vided for cable-terminal supports. Weatherproof cabinets are provided for housing the switches and cable terminals. Each cabinet is 82 in. long by 30 in. high by 9 in. deep, and is made of 0.25-in. steel plate, the joints of which are welded together. A cover is hinged at the lower front side of the cabinet, and provided with six equally-spaced lugs for clamping the cover in the closed position. When the box is closed rubber gaskets prevent the entrance of moisture and dust. End bells filled with insulating compound are provided at the terminals of the incoming cables, and the outgoing circuits are inclosed in enameled conduits. The terminal boxes were furnished by the Superior Electric Manufacturing Company, Minneapolis.

A Method of Replacing Conductors Without Interrupting Service

BY H. B. SWEENY

The method shown in the accompanying illustration has proved satisfactory for substituting one wire for



STEPS IN PROGRESS OF REPLACING LIVE CONDUCTOR OF DISTRIBUTION CIRCUIT

another without interrupting service, and can be employed where the operating voltage and the current are not too high. First, the new wire is strung over the crossarms as near as possible to the insulators which carry the wire to be replaced. Then the wire is drawn up a little tighter than the required sag, and temporarily held in place with ropes. Near the insulators which

are at the ends of the wire to be replaced, the new wire is stripped of enough insulation to provide bare wire for splicing to the wire already installed. A half-splice is then made with the skinned ends of the new wire, as shown in step II of Fig. 1, thus providing two parallel circuits, carrying currents inversely proportional to their respective resistances. The old wire is then cut at points *A* and *C* and removed from the poles. In cutting the wire great care should be taken, since arcing will occur at the first point cut, the violence of which will depend upon the current in the circuit. Parts *AB* and *CD* are then bent back, as shown in step III, and the splices completed. With this done the new wire should be loosened from the temporary rope anchors and adjusted to give the proper sag. Finally, it is lifted up on the vacated insulators and permanently tied thereto, as shown in step IV.

Benefits Derived from Steel Casing for Boiler Setting in Arizona Station

BY R. I. ELKIN

In many generating stations far too little attention is given to properly housing the apparatus that must absorb the heat produced by the furnaces. Boiler settings usually consist of a lining of firebrick built up round the boiler, outside of which ordinary brick is erected, and the whole painted with one of the various heat-resisting paints. The aim is to provide a strong wall that will prevent the escapement of heat and the influx of air. When a setting is not in first-class condition the thermodynamic efficiency of the furnace may be materially reduced because of the radiation losses occurring through the setting and by lowering the effective temperature of the fire resulting from the excess air, or air of infiltration as it is called. That is, air is drawn in through cracks and crevices in the setting, through joints between the bricks and defective clean-out doors, and even through the interstices of the brick.

The radiation loss for a boiler is practically a constant one for all loads, increasing slightly at loads above normal or full-load rating and decreasing somewhat for lighter loads. The radiation of a boiler having settings of firebrick is a very real and rather variable quantity, being about 3 to 5 per cent for the average size of boiler and setting. If the radiation loss is taken as 4 per cent at full load it will be 8 per cent at half load and 16 per cent at quarter load, hence the desirability of decreasing this loss wherever possible.

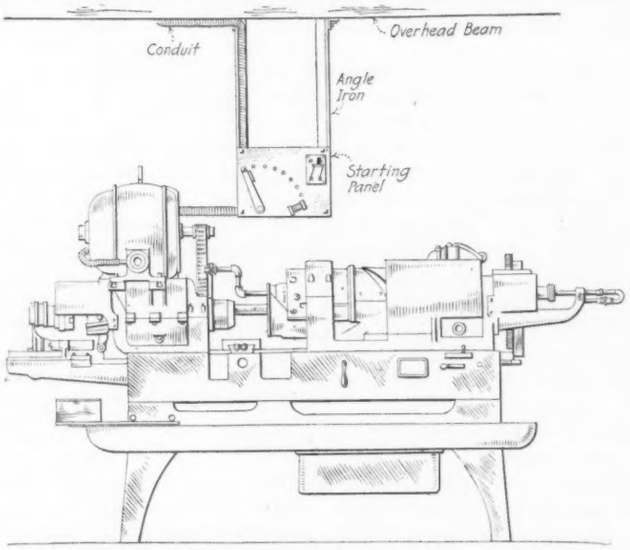
Leakage in the setting should also be watched. This is best done by analyzing the flue gases periodically, and keeping record of the CO_2, CO and O found in them. By use of two Orsat analyzing outfits or equally satisfactory meters, one placed in the top of the first pass and one just before the back damper at the top of the last pass, it is possible to determine whether the gases are being diluted by excess air drawn in through the setting, bad joints, porous brick, cracks and crevices.

In an Arizona mining district, there is a very interesting installation where radical steps have been taken to reduce radiation and infiltration losses. The plant burns oil fuel and supplies power to a copper mining company. This plant operates continuously twenty-four hours per diem and with a very high load factor. Under these conditions economy of fuel consumption is imperative, the more so since the cost of oil per barrel varies from $1.50 upward. In the endeavor to accomplish this the boiler settings have been incased in steel. The setting consists of high-grade firebrick, supported by iron or steel supports outside of which is built a sheet steel casing. The use of high-grade brick having high heat resistivity or high thermal insulating properties, and the steel casing which makes the setting practically air-tight, has effected an increase of efficiency at full load rating of several per cent, while the efficiency at loads of 50 and 75 per cent is even higher than at full load by from 1 to 2 per cent. In any boiler with ordinary settings the ratio of radiation loss generally increases at such a rate at light loads that the efficiency drops although the boiler absorption efficiency increases due to the more effective absorption of heat, from which the very real gain due to incasing the brick setting in sheet steel is obvious.

It is understood that this same practice is now being used in the settings of some of the 2365 hp. boilers at the Delray Station of the Detroit Edison Company, with equally satisfactory results. The cost of such a casing should not add materially to the initial cost of the boilers, and would soon pay for itself with the customary load factors met with in central station practice. In fact, the use of such a casing seems particularly beneficial to central stations because they usually operate boilers at ratings in excess of normal over the peak load periods and then, when the peak is over, bank their fires. Sudden temperature changes work havoc with a boiler setting, whereas high temperatures long sustained do far less damage. Forcing a boiler and then dropping the load and banking the fire is about the most severe service to which a setting could possibly be subjected, and will cause cracks and crevices to form, followed by air infiltration with all that accompanies it. The steel casing for boiler settings, therefore, deserves careful consideration, as a means of effecting economies of operation and maintenance.

A Convenient Place for Machine-Tool Motor Control Apparatus

A convenient method for installing starting equipment for individual motor-driven machine tools by suspending it above the tool is shown in the accompanying illustration. The starting panel is supported on two pieces of light angle iron attached to an overhead



AN OVERHEAD SUPPORT FOR MACHINE-TOOL MOTOR STARTER

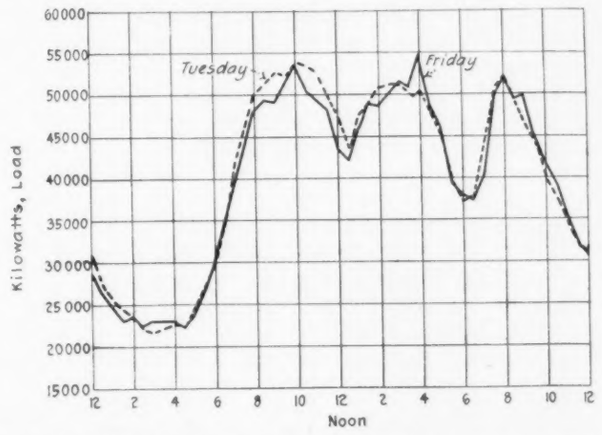
beam. The control circuits are brought to the panel in conduit and run along the beam and down the side of one of the angle-iron supports. Although installing starting equipment in this manner may be slightly more expensive than installing it on near-by posts or columns the arrangement conserves floor space and places the equipment in a position where it is easy to operate.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

Load Curves That the Electric Range Can Level

The Southern California Edison Company has its maximum peak in summer, at which season of the year the evening electric-range load comes on ahead of the lighting peak. Thus the slight increase of the winter peak which the electric ranges will produce does not mean any increase of the maximum load. With this primary objection out of the way, the range effect on the load curve is expected to be entirely beneficial, filling in the noon and evening valleys and broadening the morning and evening peaks during most of the year. At the end of May the Los Angeles company had more than 600 electric ranges on its system, and the number is being rapidly increased.



TYPICAL DAILY LOAD CURVES FOR SOUTHERN CALIFORNIA EDISON SYSTEM; NOTE THE BROADENED "ELECTRIC-IRON PEAKS" OF THE TUESDAY MORNING LOAD

The load curves herewith, representing the hourly demands for typical days in May, 1916, show the general conditions on this company's system. The shape of these curves is maintained relatively the same until September, when the evening peak will become relatively higher than the morning peak by an amount depending upon the dryness of the weather, which affects the pumping load.

The breadth and relative height of the Tuesday morning peak is pointed out with much pride by the company as the "electric-iron peak."

Cost of Closing Electric Service Contracts

The cost of securing contracts for new lighting business in the territory of an Eastern central station company last year amounted to about 19 cents per 50-watt equivalent, or $7.43 per contract on the average, according to figures prepared by the general sales agent of the company. Compared with the corresponding expenses in several of the larger Eastern cities this is declared to be relatively low, the average expense reported from other companies being $8.89 per contract and the maximum $10.33.

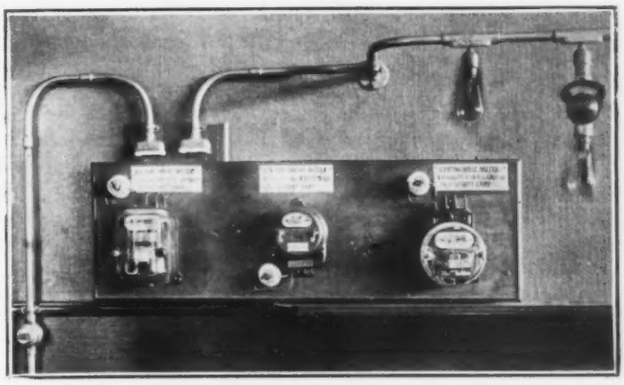
Particular attention is also called to the fact that it costs about three or four times as much to serve and maintain consumers' electric-service facilities as it does to generate the energy supplied.

To reduce this expense the company above referred to is considering the advisability of installing prepayment meters on its small customers' lines.

During 1915 a total of 1447 devices, having an aggregate rating of 682.46 kw., were sold by this Eastern company at a profit of $1,665.67, or 0.24 cent per connected watt. Based on the cost, this represents 43.5 per cent profit on the average and $1.15 per article sold. An analysis of the figures presented shows that the profit per watt on irons was 0.192 cent, on percolators 0.424 cent, on toasters 0.21 cent, on glowers 0.23 cent, on disk stoves 0.26 cent, on Christmas-tree lamps 0.23 cent, on fans 0.14 cent, and on vacuum cleaners 4.2 cents. Of the total number of devices sold, about 65 per cent were irons, 10 per cent toasters, 4 per cent fans, and 3.5 per cent percolators.

Aiding Customers to Make a Rough Check of Their Own Meters

Many electric lighting customers get the impression —and not always an erroneous one—that their meters are running too fast; and they would like to learn of some means to check it up themselves. Thomas Crawford, general manager of the Clinton (Iowa) Gas & Electric Company, has shown his public the way. In the display room in the company's office he has had mounted on the wall one of each of the three types of meters used by the company. Beside these are placed a group of 60-watt lamps which are individually in circuit with the meter, and may be turned on to show how fast the meter disk revolves when any lamp is burning. Above each meter is a statement of the number of revolutions in so many seconds that the disk makes for one 60-watt lamp. With this information, the customer can check his own meter and satisfy himself that it is not running too fast. Frequent telephone calls come in asking for this information, the customers having seen the data in the office but forgotten the figures when they want to check their meters. The result of this exhibit has been a noticeable decrease in meter complaints.



AT CLINTON, IOWA, THIS BOARD IS USED TO ENCOURAGE THE CUSTOMER TO READ HIS METER AND CHECK ITS ACCURACY

A Municipal-Ownership Advocate's Views on Depreciation

In the discussion of his address on "The Making of Electric-Service Rates," presented before the Ohio Society of Mechanical, Electrical & Steam Engineers at Cleveland recently, F. W. Ballard, consulting engineer and formerly director of the city's municipal generating station, said that in making valuations of electrical plants he allows for depreciation 3 per cent per year on the cost new. At the rate of 3.90 per cent, an amount placed out at compound interest and allowed to remain undisturbed, will accumulate to the amount of the original investment in twenty-two years, Mr. Ballard said. The time required will be a little greater, of course, at the rate of 3 per cent.

Obsolescence will wipe itself out eventually by the saving secured from more modern machinery and equipment installed, he declared. A new turbine will pay for itself in ten years, he estimated, from the saving over the operation of the old cross-compound engine, which is often replaced. In order that obsolescence may be taken care of, and at the same time amortize the original investment, Mr. Ballard suggested that a depreciation fund at the rate of 3 per cent a year be maintained; that funds for new equipment to replace the old be taken from this, and that the saving effected by the new equipment be paid into the depreciation fund until the amount thus expended had been returned. In this way the fund will be maintained, and then if the plant is ever allowed to become extinct for any reason this fund will take care of the original investment and there will be no loss to anyone.

The return for investment under these circumstances, said Mr. Ballard, should be on the original value of the plant. It was suggested at the convention that additions to plants cost much more than they would if built with the original installation, and Mr. Ballard said that in estimating the cost of reproducing a plant new an allowance is usually made for piecemeal construction. This, he said, could also be taken care of so that the fund would cover it in the end. If no depreciation fund is maintained or a portion is paid out to stockholders for dividends, Mr. Ballard contended that in making rates the return allowed should be on the depreciated value of the plant only.

Town Lighting as a Factor in General Business Activity

The last bulletin of the Free Service Bureau for Retailers, maintained by the wholesalers and jobbers of St. Joseph, Mo., contained a page article, with illustrations, pointing out that "Light Makes a Better City and Brighter Business." The bulletin is issued to assist the retailers of the small towns in the St. Joseph trade territory to make larger profits.

But in trying to build up the trade of the country merchant, so that the St. Joseph jobbers will get more business from him, the Free Service Bureau has found it desirable to build up surrounding communities, liven the towns, and promote community welfare. The bureau has been supporting the movement for good roads —and now it is advocating better lighting for the towns, as a means of increasing retail possibilities.

Service of this nature, from local bureaus and even from papers devoted to particular trades, has seldom emphasized the advantage of adequate and attractive street lighting. There is, however, a particular reason for the St. Joseph bureau to realize the value of good lighting.

This lies in the fact that the St. Joseph Railway, Light, Heat & Power Company is locally regarded as the strongest "booster" the city has. "We can always count on the company to help in any worthy project," say the merchants and business men. Officers of the company are active members of the Commerce Club and other organizations—they do detail work, planning, or anything they are called upon to perform, and the company cooperates actively in local affairs. When any new enterprise is started by any organization, almost inevitably one or another officer of the company is brought into consultation, and asked for advice and help.

St. Joseph has a motto, "The City Worth While," blazoned on its tallest building in electric letters readable thirty miles away. Heretofore visitors to St. Joseph realized the part electricity bears in making a city prosperous and attractive; but now the "gospel is being carried" to all the trade territory of St. Joseph.

A Motor Installation That Quickly Earned Its First Cost

By agreeing to replace some old 80-hp. steam-engine equipment used by the Victor Manufacturing Company, Leavenworth, Kan., manufacturers of washing machines, with several group-drive motors which would do the same work, and arranging to allow the manufacturer to pay for his equipment and the cost of installing it, out of the monthly savings resulting from the use of electrical equipment, the Leavenworth Light, Heat & Power Company has secured a pleased customer who says that he would not go back to steam drive under any consideration.

With the old steam equipment it was necessary to employ a man to take care of the engines and boilers. Furthermore, extensive belting and lineshafts were required, and the equipment occasionally had to be shut down for a week at a time to overhaul the engine and boiler. Other interruptions to service were also experienced with the steam equipment.

All of these difficulties have been eliminated, however, with the present motor drive, and the operating cost has been cut in two so that the electrical equipment was some time ago paid for out of its savings.

The present motor equipment consists of seven motors ranging in size from 0.5 hp. to 7.5 hp. One 7.5-hp. motor operates the plating equipment, a punch press, two boring machines, a lathe milling machine, and a cross-cut saw. This motor is fastened to the ceiling in the basement and drives the above-mentioned apparatus through belting and a shaft. Another 7.5-hp. motor similarly supported in the basement operates a power press and a turning lathe. A rip saw, a planer and an exhaust blower are each driven by individual motors. As four of the seven motors are situated in the basement, practically all belting on the main floor has been eliminated with a consequent saving in space and increased safety for plant employees.

Elkhart, Ind., Has 80 Per Cent of its 5000 Dwellings Wired

Elkhart, Ind., now makes a claim for fame as "the electric city of Hoosierdom." There are approximately 5000 dwelling houses in Elkhart and of these four-fifths are equipped with electricity according to data just made public by the Indiana & Michigan Electric Company. The reduction on April 1 in the net rate from 10 cents to 7½ cents per killowatt-hour was a big boost to business. In 152 days of this year there had been added 370 new residence connections, an average of two and a half per day.

Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

Colored Lamps Supplement Flood-Lighting of Two California Courthouses

The impression that the spectacle of the San Francisco Exposition lighting has left on the people of the United States, and particularly on the California public who had the opportunity to view it night after night, is being evidenced by the wide interest since manifested in flood-lighting by the exposition method of exterior illumination of buildings. Many of the towns and counties of California which boast of attractive city halls or courthouses have taken measures to flood-light these architectural gems or have the matter up for consideration. In many instances where buildings were outlined with incandescent lamps, the more modern system is being considered, not only because it is more beautiful, but because of the greater economy which is effected.

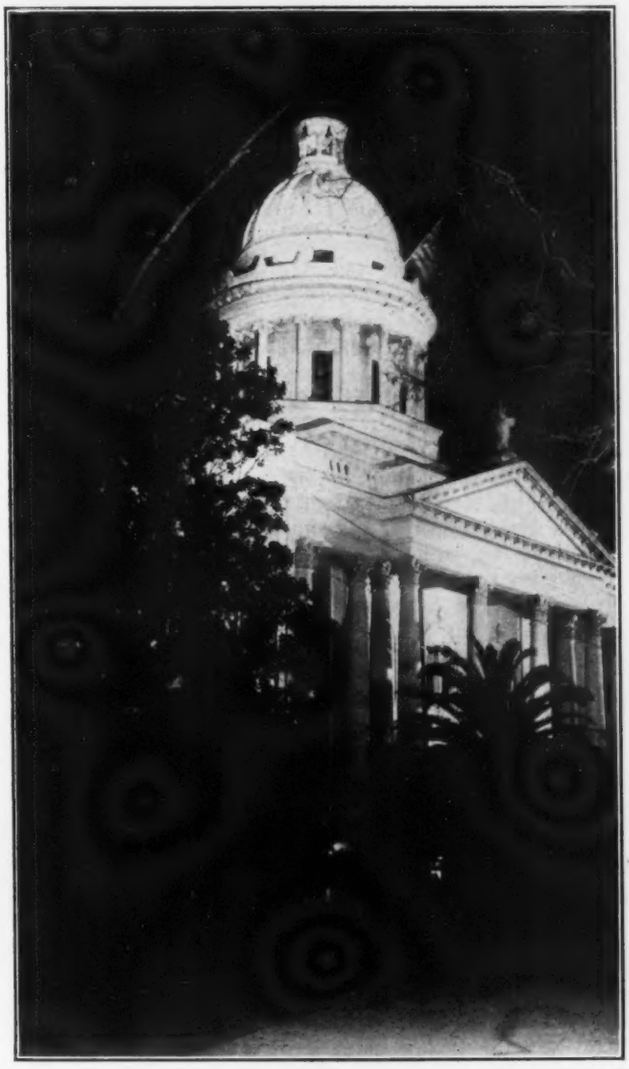


FIG. 1—THE FRESNO COUNTY COURTHOUSE FLOOD-LIGHTED BY NINE 500-WATT PROJECTORS

FIG. 2—THE SAN JOAQUIN COUNTY COURTHOUSE AT STOCKTON, CALIFORNIA

The structure is shown illuminated by four 500-watt flood-lighting projectors. Like the Fresno courthouse pictured below, the Stockton building is equipped with banks of red-dipped tungsten lamps behind the colonnades about the dome, which project a soft rose tint over the parts that would otherwise be in shadow

Fig. 1 shows the Fresno County courthouse at Fresno, Cal. This building is lighted by nine 500-watt General Electric flood-lighting projectors, placed in three banks, one group of four units being mounted to the right, one of three units directly in front, and a single unit to the left. The three banks of units are each placed about 250 ft. from the building. They are mounted on raised platforms concealed among the trees and supplied with service from the building.

Fig. 2 shows the courthouse at Stockton, Cal. Here four 500-watt flood-lighting units were used, located on the roof of a three-story building directly across the street, about 300 ft. away. As this building is in the center of a beautifully parked square, in the most prominent part of town, it is planned to light all four sides with twenty projectors in four banks of five units each, each bank to be located on the roof of the building opposite each corner of the square.

A very beautiful and compelling feature of the lighting of the Fresno and Stockton courthouses is not brought out by the photographs. This is the red lighting back of the columns at the base of the domes and back of the railings at the center of the domes. Red-dipped Mazda lamps were used, being equipped with reflectors concealed from view by mounting them back of the columns and railings. The flood of soft red light, being faded to a rose pink by the more intense brilliant white light from the projectors, has the effect of deepening the niches and coloring and at the same time subduing the shadows cast by the columns and projections.

In turning on the lights at the approach of darkness, a beautiful effect is obtained. Promptly at sundown the red lights are turned on, which in the early twilight appear a faint pink. As the twilight gradually deepens, the colors come up to a rich red, which is again suddenly transformed to a rose pink by the white light of the projectors when they are turned on, after the last trace of daylight has disappeared. The wonderful moving shadow effects on the fronts of these two courthouses produced by the graceful waving palm trees in the foreground can only be appreciated by one who has viewed the illumination at night.

Installing Switch Boxes in Partitions in Old Houses

In installing switches in partitions in old residences which are being wired it often happens that, unless the wireman is very careful, either too much plaster is broken away around the opening made in the partition, leaving unsightly holes around the edges of the switch plate, or else trouble is encountered in holding the switch box in place because the laths which should support the box have been cut away too far. These

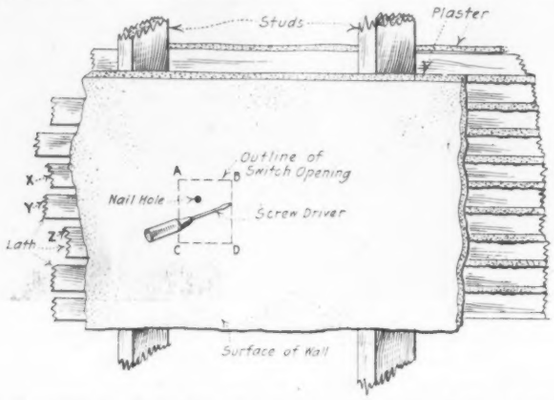


FIG. 1—AFTER LOCATING THE LATH POSITIONS WITH A NAIL, THE RECTANGLE *A B C D* IS MARKED AND THE PLASTER CUT OUT WITH A SCREWDRIVER

difficulties can be easily avoided if the method herein described and illustrated is followed.

When the approximate location of a switch has been determined, an 8-penny or 10-penny nail is used as a probe within the area to be occupied by the switch until a space between two laths has been found. After this space has been located, an outline of the area of plaster to be removed, *ABCD*, Fig. 1, is made with a pencil so that the top and bottom lines, *AB* and *CD*, respectively, lie approximately half-way between the widths of laths *X* and *Z*. The idea in so locating the outline of the switch opening is that when the opening has been cut the top half of lath *X*, just above the line *AB*, and the bottom half of lath *Z*, just below line *CD*, will remain in place. Screws which hold the switch box, Fig. 3, in place will then penetrate the upper half of lath *X* and the lower half of lath *Z*, thus supporting it securely.

After the location of the switch opening has been definitely determined and the outline thereof has been made, a small screwdriver is used to punch through the plaster along the outline lines, *ABCD*, Fig. 1, so that the area of plaster within the outline may be removed without disturbing any of the plastered surface which surrounds it. In punching through the plaster the blade of the screwdriver is held lengthwise upon

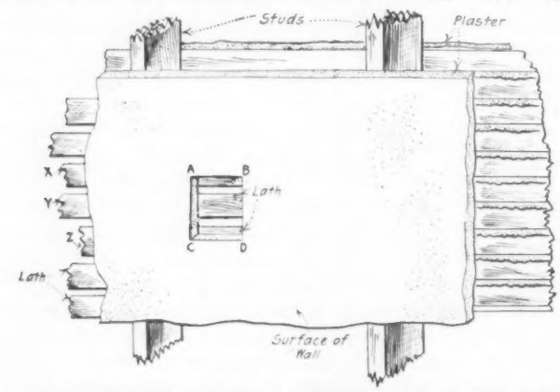


FIG. 2—THE EXPOSED LATHS ARE THEN CUT AWAY WITH A KEY-HOLE SAW AND THE SWITCH BOX INSERTED

the outline lines, the butt of the screwdriver being given slight blows with the hand until the blade has passed through the plaster to the surface of the laths. When the outline has been entirely punched through as just directed, the area *ABCD* of plaster can be easily chipped out without disturbing any of the surrounding plaster, thus exposing laths *X*, *Y* and *Z*, as shown in Fig. 2.

The exposed laths are now cut away with a keyhole saw and the switch box is inserted. The ears of the box (Fig. 3) should rest on the finished wall surface. When the box is screwed in place a few added turns on the holding screws will bring the surface of the ears

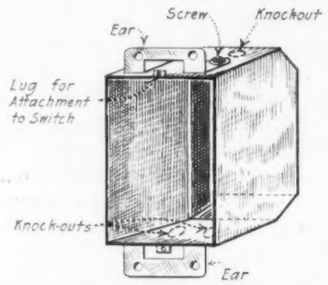


FIG. 3—THE EARS OF THE SWITCH BOX SHOULD REST ON THE FINISHED WALL SURFACE

flush with the finished surface of the wall, provided the plaster is not too hard. If the plaster is hard, a small recess to receive the ears of the box so that they will lie flush with the finished wall surface, should first be chipped out with a screwdriver.

Changing Inks and Typewriter Ribbons to Avoid Increasing Illumination Expense

In office lighting the present tendency is toward general illumination and the elimination of desk lights. The entire office, as pointed out by one writer, is in this way made more attractive to employees and the public. Greater personal efficiency has been accomplished through lessened eyestrain caused by glare from poorly-shaped lamps and too brilliantly lighted papers, and by tiresome readjustment of the eye in glancing from the bright desk into the comparatively dark room and back again.

But there are two things which are sometimes ignored when changing from local to general office lighting—the light tints of ledger inks and colored typewriter ribbons. Where these remain in use general lighting will cause complaint, unless it be of an intensity higher than necessary for comfort in the reading of books and papers printed in black type. It is usually cheaper to change the ink or ribbons than to maintain unnecessarily high intensity of illumination.

Flood-Lighting the Flag

The 15-ft. by 10-ft. American flag which waves above the roof of the Hartford (Conn.) Electric Light Company's office, is flood-lighted nightly by two 500-watt projectors. These units are located about 55 ft. from the flag, the spread of the light including an area sufficient to cover the flag's full length, whichever way it may be flying. Each projector illuminates only one side of the flag, but the light shines through the fabric so effectively that the illusion of direct flooding of the national emblem is maintained under all conditions. The building's height and commanding location enable the illuminated flag to be viewed from all parts of the city.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

EXCESS HYDROELECTRIC POWER

Raising Steam by Electric Heating—Results Obtained in a Swiss Plant

IN many hydroelectric plants there is for some months of the year an excess of energy which is to a large extent not utilized. The use of this energy for raising steam in the boilers of a reserve steam plant has naturally suggested itself and experiments along this line have been made, first with two steam boilers, by the electric supply company of Zurich, Switzerland, at its Letten plant. As a result of these tests the company has ordered two new sets of electric heating elements, shown in Fig. 1, for a third boiler, the section of which is given in Fig. 2. This apparatus has been in operation since September, 1915, and a description is given in *Schweizerische Bauzeitung*, of April 8, 1916, and in *Le Génie Civil* of May 27, 1916.

The electric heating sets are arranged as shown in the illustration and consist of resistance elements *A* of cast iron, insulated with mica and eternit. The use of any easily fusible or expensive metal or of any solder has been avoided. Each heating unit consists of six resistor sets, which may be connected at will according to the particular conditions. The connections are made

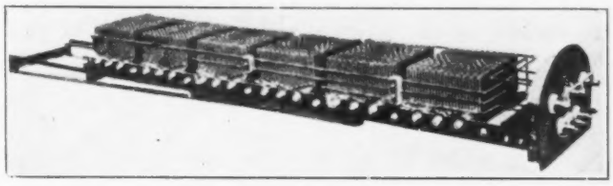


FIG. 1—ARRANGEMENT OF HEATING GRIDS AND TERMINAL CONNECTIONS THEREFOR

at the binding posts on the end wall (at the right of Fig. 1) which also has a window through which the interior may be observed. While electric heating is carried on the heating chamber is hermetically closed. The maximum temperature of the heating resistors is below 600 deg. C. (1112 deg. Fahr). The boiler of Fig. 2 has 180 sq. m. (1937 sq. ft.) heating surface and contains 17 cu. m. (4490 gal). of water. With a maximum consumption of 84 to 86 kw., 1720 kg. (3784 lb.) of steam is produced in twenty-four hours and the steam is utilized in various ways. The three boilers of the Zurich station, equipped with electric heating sets, furnish in the whole 5630 kg. (12,386 lb.) of steam per day with a consumption of 7392 kw.-hr., saving 750 kg. (1650 lb.)

TABLE I—TIME REQUIRED TO HEAT BOILER ELECTRICALLY

Number of Hours	Amperes	Temperature in Heating Chamber		Effective Boiler Pressure in Atmospheres
0	116	27 deg. C.	81 deg. Fahr.	..
12	37	41 deg. C.	105 deg. Fahr.	..
24	37	51 deg. C.	124 deg. Fahr.	..
48	93	76 deg. C.	169 deg. Fahr.	..
54	92	86 deg. C.	187 deg. Fahr.	0.4
72	90	108 deg. C.	226 deg. Fahr.	2.4
84	91	123 deg. C.	253 deg. Fahr.	4.4
96	90	138 deg. C.	280 deg. Fahr.	6.6
102	91	142 deg. C.	288 deg. Fahr.	7.3
108	90	145 deg. C.	293 deg. Fahr.	5.9
126	91	133 deg. C.	271 deg. Fahr.	4.8
144	90	137 deg. C.	279 deg. Fahr.	4.6
162	91	140 deg. C.	284 deg. Fahr.	5.4

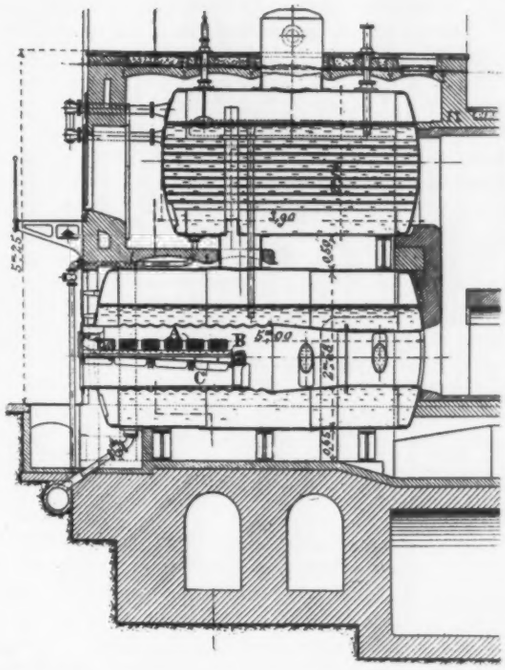


FIG. 2—CROSS SECTION OF BOILER EQUIPPED WITH ELECTRIC HEATING GRIDS

of coal a day. This is a specific consumption of 1.31 kw.-hr. per kilogram of steam (0.6 kw.-hr. per pound of steam).

Table I shows how long it takes to heat the boiler from cold state to normal operation. As will be seen in this test the boiler reached the normal pressure of 7 atmospheres in 100 hours; the decrease of pressure in the following hours was due to the fact that the boiler was then supplied with cold water of 16 deg. C. (61 deg. Fahr.).

In order to operate the boiler with coal as fuel, the unit of electric heating elements is removed from the boiler. This may be easily done in half an hour. The use of electric power for steam raising is proposed only for those periods in which excess power is available which would otherwise be wasted.

Generators, Motors and Transformers

Design of Direct-Current Machines.—STANLEY PARKER SMITH.—The first parts of an article in the first half of which the author deals with the principles underlying the design of continuous-current machines, while in the second half the principles are to be applied to the design of a 350-kw., 500-volt generator running at 200 r.p.m. The first two installments give the theory of the emf. induced in a coil moving in a pulsating field; the emf induced in a winding rotating in a steady flux; the emf. at the commutator brushes; and armature windings for direct-current machines. This is the beginning of a general serial on the design of electro-magnetic machines which is intended to fill the gap between elementary text-books and the authoritative treatises for specialists.—London *Electrician*, June 2 and 9, 1916.

Theory of Commutation.—M. Ascoli.—The author criticises the usual theory of commutation, the fundamental criterion of which is $L < RT$. According to his theory the correct criterion is $2L < RT$; from this relation the author deduces some consequences on the most favorable emf. of commutation.—*Elettrotecnica,* May 5, 1916; briefly abstracted in *La Revue Elec.,* June 2, 1916.

Higher Harmonics in Transformers.—George R. Dean.—A mathematical paper on the predetermination of higher harmonics in the alternating-current transformer when the impressed emf. is a simple harmonic function of the time.—London *Electrician,* June 9, 1916.

Lamps and Lighting

Flicker-Photometer Frequency.—Leonard T. Troland.—A note from the Nela Research Laboratory. The flicker-photometer frequency of any two visual stimuli is defined as the rate of alternation (cycles per second, with equal intervals) of the two in the same photometric field, which is just sufficiently rapid to eliminate flicker, when the ratio of their intensities is such as to give a minimum of flicker at a slightly lower rate. A brief account is given of an experimental investigation of flicker-photometer frequency as a function of the color of the standard, and of the measured light. Two series of measurements were taken with sixteen spectral colors and a "physiological white" standard, of constant intensity for each series. The flicker-photometer frequency for a white standard varies radically with the spectral character of the measured light, being greater at the ends of the spectrum than in the middle. The flicker-photometer frequency is determined primarily by the character of the spectral stimuli, in relation to white, although a marked color tone in the standard will shift the position of the minimum. No influence of the color of the standard upon the intensity required for a match was apparent within the limits of reliability of the measurements. The photometric sensibility, however, was found to depend on the color of the standard, and also on that of the measured light. The sensibility was exceedingly low in the red.—*Journ. Franklin Inst.,* June, 1916.

Installations, Systems and Appliances

The Uneconomical Small Station.—An editorial note on the poor economy of coal consumption in some small steam-generating British stations, with special reference to Stoke-on-Trent. In the case of Longton, in which the units generated during the year amounted to only 37,920, the coal per kilowatt-hour was as high as 21½ lb. At Stoke, with nearly double the output, the coal per kilowatt-hour was 13¾ lb., and even at Hanley, with 849,332 kw-hr. generated, the coal per kilowatt-hour was 12 lb. As against this the coal consumption is 2¾ lb. per kilowatt-hour with an output of 9,960,796 kw.-hr. at the modern power house. The effect of running the turbine plant at the power house was to change the net loss of $30,810 in 1913-1914 to a net profit of $355 in the following year. The Council now has under consideration the installation of another turbine set, and this will bring about a sufficient saving of coal to pay the capital charges on the new plant. Such figures do not refer by any means to isolated cases. There are numbers of comparatively small stations in Great Britain in which the coal consumption is necessarily very high. If these could only be supplied in bulk from the large undertakings there would be a great saving to the country in coal.—London *Electrician,* June 2, 1916.

Battery Rooms.—George R. Archdeacon.—The author points out the grave errors often made in the design and location of battery rooms and gives some practical hints. The battery room should be lofty and situated in an open space where it has access to the wind in all directions. Thorough ventilation is very important. Dust and dirt should be kept out. The ceiling and walls may be entirely finished off with concrete instead of plaster. Ample but equal distribution of light should be provided. There should be sufficient working space. The floor of the battery room may be covered with acid-resisting tiles, with tiled gutters running down the sides of each row of cells; or, if preferred, the floor to the depth of 2 in. can be of rock-asphalt, having a whaleback form to drain down to the gutters. In any case, however, to get a good level surface, about 12 in. of cement concrete should form the foundation for any construction it is intended to employ. The cells should be erected in single tiers only. It is an advantage to make an alleyway across each row of cells half-way down, leaving elbow room and head room with the connections. The ideal temperature is 60 deg. Fahr. The battery room, therefore, should be constructed so that the temperature rarely exceeds 65 deg. Fahr.—London *Elec. Rev.,* June 2, 1916.

Wires, Wiring and Conduits

Fault in Bitumen Cables.—An anomymous account of some peculiar phenomena on a power distribution system which contains some 25 miles of cable laid solid with bitumen in wooden troughing. The cable is looped up every 10 ft. and connected to some 15,000 magnetically-operated switches with a bitumen seal between the trough and the switch boxes. Normally the cable is positive and the negative return is through steel rails at earth potential. The system has been in operation fifteen years, and has given very little trouble. One day, for a short time—a few minutes—the polarity was reversed, with the result that alarming leakages developed at several switch boxes, ultimately necessitating the renewal of the bitumen and compound seal at about 200 points. The normal voltage is 500 direct-current, and the leakage current registered on the morning of the breakdown on the sections affected was 0.26, 0.03 and 0.018 amp. On investigating the cause of the trouble a series of experiments was made. First, a test was made on three different sections with about thirty switches on each. Leakage current with cable positive: (a) 14 milli-amp., (b) 1 milli-amp., (c) 1 milli-amp. Leakage current with cable negative; (a) 23 milli-amp., (b) 5 milli-amp., (c) 2 milli-amp. Then lengths of bare cable were carefully insulated with bitumen tape and pierced with several pinholes. Each cable was coiled up and placed in a metal box about 12 in. by 8 in. The boxes were then filled with damp sand. No. 1 cable was connected to the positive terminal of the 500-volt supply, and the metal box it was in was connected to a negative terminal. No. 2 cable was connected to the negative and box to positive. An ammeter was placed in circuit. Megger test on each registered over 50,000 ohms. Current was switched on, and after three minutes No. 2 cable registered 0.025 amp., and No. 1 50,000 ohms. After six minutes, No. 2 reading 1.1 amp., No. 1 50,000 ohms, current was reversed and in a few seconds the leakage on No. 2 dropped to 0.2 amp. In three minutes a leakage of 1 amp. was registered on No. 1. The current was again reversed to pass through as originally, and in ten minutes No. 1 registered 0.05 amp. and No. 2 was rising quickly from 2 amp. On opening up, No. 2 cable was found saturated with moisture, and, of course, steaming from the heat of current leakage and No. 1 cable was found in a comparatively normal state. The experiment was repeated with one box, and the result was plotted as shown in Fig. 3. Some of the author's conclusions are as follows: At least an incipient mechani-

cal fault is necessary before a leakage is observed. The flow of moisture from positive to negative is perhaps best described by the electro-medical term "cataphoresis." In using vulcanized bitumen cables on the nega-

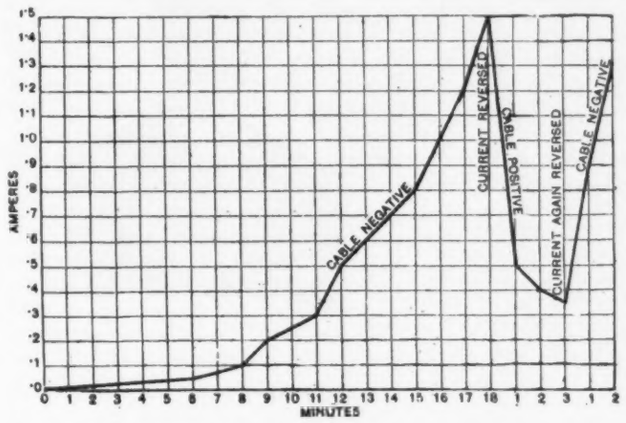


FIG. 3—EFFECT OF POLARITY REVERSAL ON LEAKAGE FROM BITUMEN INSULATED CABLES

tive side of a direct-current system great care should be taken, in order to prevent mechanical damage which causes incipient faults in the cable, which will with the presence of moisture cause faults to develop by "cataphoresis." Similarly, great care should be exercised in hermetically sealing the end connections.—London *Elec. Rev.*, June 2, 1916.

Electric Insulators.—An abstract of an address before the Newcastle-on-Tyne Section of the (British) Inst. Elec. Eng. According to Maxwell's electro-magnetic theory of light, the specific inductive capacity K, of an insulating medium should be equal to the square of its refractive index n. For air, petroleum, carbon disulphide, paraffin wax, etc., this rule holds good, but for other insulators like flint glass, quartz, alcohol and distilled water, it does not hold. That discrepancy has been completely explained on the electron theory of matter. The electrons which are contained in a dielectric molecule can not be torn from it, but can be displaced within it. The differences between K and n^2 are "due to the presence in the medium of electrons having free periods of oscillation coinciding with the frequency of light in the ultra-red part of the spectrum." The behavior of a good electrical insulator, such as quartz, is that of a perfect insulating medium loaded with electrons anchored elastically in each molecule of the substance, whose movement to and fro, as the electric field reverses, gives rise to the value of the dielectric constant observed in low-frequency fields. In addition to the exceedingly small displacement just considered, there is at frequencies lower than those of light, a secondary effect of great practical importance, since the amplitude of movement is relatively so great within the molecule that the electrons in any one molecule are strongly influenced by electrons in neighboring molecules. The displacement in low-frequency fields is no longer a simple elastic effect. It had two clear stages, the instantaneous polarization just considered, which occurs at the velocity of light, and a secondary inter-attraction, started by the first polarization, elastic in the sense that when the field is released, the electrons return to their original position. That is familiar in the residual charge of a condenser left standing after being charged and discharged. The first spark at discharge is the release of the first stage, the residual spark arises from the inter-attraction between opposite electrons dying down. The dependence of the residual charge on the original polarization is made clearer by the fact discovered by Hopkinson, that the total residual charge is proportional to the original charging voltage. One result of this inter-attraction is loss of energy by hysteresis. In engineering, the movement of the electrons is forced, for even where there is resonance in a cable system the free period is much below that of the electrons. Referring to polarization in steady fields, the speaker said that when a steady field is applied to a dielectric, inter-attraction has full scope. In moderate fields it proceeds to a limit independent of the intensity of the field, and it may take days to complete. The polarization is then in most materials many times greater than for rapid reversals, so that the dielectric coefficient corresponding to the slowest possible polarization is much higher than even for one minute's electrification. On switching-off and insulating a cable which has been under continuous voltage for a few days, the inter-attraction slowly relaxes, and the total quantity releases, which corresponds to the above high dielectric coefficient, may be sufficient to raise the insulated conductor to a dangerous potential. Rubber cables may have from four to five times their original charging voltage. Quartz and glass reaches more than 100 times their starting values. The danger in the case of a cable left standing is that the charge which has soaked out is not bound, but free, so that the shock from it is much greater than from a charge—discharge spark. It is common knowledge that the best way to release the residual charge is to short-circuit the conductors for several days after use. The inter-attraction between the polarized atoms or molecules in a dielectric has great influence on its electric strength. In fact, it takes complete charge of the material after a certain voltage has been reached, and determines the electric strength. The action is found in solids, liquids and gases. When there is absorption caused by inter-attraction, the polarization increases to a value independent of the strength of the applied field and depending only on the structure of the atoms or molecules. Referring to experiments on the influence of time of application on break-down voltage, the speaker said that the fact that it has a finite value when v (voltage) and t (thickness) are exceedingly small, shows that the thinnest possible substance requires a definite time to break down. There is a thickness which cannot be broken down, for it would take an infinite time to establish the state of failure. The speaker referred in some detail to the breakdown voltage of liquids and solids, and added that it could be stated as a general law for solids, liquids or gases, that their failure under electric stress has two stages. In the first stage the work done on the material up to the point of failure is independent of the thickness of the specimen or length of spark gap. In the second stage, inter-attraction is in one sense more important than the applied field. Beyond the point of transition, the work of break down is not independent of thickness, but is a linear function of the voltage.—London *Elec. Rev.*, June 2, 1916.

Telegraphy, Telephony and Signals

Mine Signals.—R. H. GOULD.—A paper on a new system of mine signaling. Trembling bells in underground mines have the disadvantage that the make and break may go out of adjustment. The single-stroke bell requires a larger current than the trembling bell, so that it is difficult to work a number of single-stroke bells in parallel. In the author's system hooters are employed instead of bells. The hooter is constructed on the lines of a telephone receiver and consists of a coil, a steel magnet and a diaphragm. The chief advantage of the system is that the only vibrating contacts are overground on a switchboard where they are readily accessible. *Transactions, South African Inst. Elec. Eng.*, April, 1916.

G. W. HUBLEY

Men of the Industry

Changes in Personnel and Position—Biographical Notes

G. Wilbur Hubley, who has been appointed general manager of the Merchants' Heat & Light Company of Indianapolis, Ind., was for more than twenty years chief engineer and superintendent of public service properties in Louisville, Ky. Mr. Hubley's earlier work in the electrical field was with the Westinghouse Electric & Manufacturing Company and also with the Citizens' Traction Company of Pittsburgh, Pa. In these connections, his experience included construction and operation of plants and the management and organization of properties. He had charge of the complete electrical installation of the Terre Haute (Ind.) street railway, one of the first street car systems in the United States to be converted to electric traction. At Louisville, he supervised the construction of a new 20,000-kw. steam-turbine plant, a 5000-kw. substation and the installation of a complete system of underground distribution subways. Mr. Hubley was for many years chief engineer and superintendent of the old Louisville Lighting Company and resigned his position with its successor, the Louisville Gas & Electric Company, to join the electrical engineering staff of the Jones & Laughlin Steel Company of Pittsburgh. Mr. Hubley is a member of the American Institute of Electrical Engineers, and is a past-president of the Engineers & Architects' Club of Louisville.

P. Thwaites Sealey has been appointed electrical engineer of the Bethlehem Chile Iron Mines Company, a subsidiary of the Bethlehem Steel Company, and, accompanied by his family, will sail for Chile on July 1. Work has been started on the 2400-volt railway, and it is expected that both the railway and electric mining shovels will be in operation early in 1917.

G. T. McFarland of Lynn, Mass., who has for several years been connected with the automobile equipment division of the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., as New England district engineer, has accepted a position as manager of the Ashwell Service Stations, with headquarters at Hartford, Conn., handling all kinds of electrical equipment for automobiles.

W. W. White has been appointed superintendent of the municipal electric light plant at Bolivar, Tenn., succeeding F. M. Smith, recently resigned.

Alex Dow, president and general manager of the Detroit Edison Company, has been appointed to the Detroit board of water commissioners.

Adolph M. Barron, who has been general manager of the Tri-County Light & Power Company of Aledo, Ill., has resigned to embark in other business in California.

Ralph James has been appointed superintendent of the Oregon Power Company at Junction City, Ore., succeeding F. M. Hildreth, recently transferred to Corvallis, Ore.

R. U. Steelquist, formerly manager of the Oregon Power Company at Corvallis, Ore., has been appointed superintendent of the Dallas division, succeeding A. L. Martin, recently resigned.

F. M. Hildreth, formerly superintendent of the Oregon Power Company at Junction City, Ore., has been appointed superintendent at Corvallis, Ore., succeeding R. U. Steelquist, recently transferred to Dallas, Ore.

Ralph Elsman, formerly engineer with the Pacific Gas & Electric Company of San Francisco, has accepted a position as engineer on underground work with the Electric Bond & Share Company, New York City.

C. M. Tolman, chief electrical engineer of the Bangor (Me.) Railway & Electric Company, has tendered his resignation to accept a position as electrical engineer with the Ironwood & Bessemer Railway & Light Company of Ashland, Wis. Mr. Tolman has been connected with the Bangor company for fourteen years.

W. C. Frye, the newly elected president of the Chain Belt Company, Milwaukee, Wis., has been with the company for the last twenty years. He is also treasurer of the Sivyer Steel Casting Company, Milwaukee; vice-president of the Federal Malleable Company, Milwaukee, and a director of the new Electric Steel Casting Company, Chicago.

Harlan A. Sawyer, manager of the Amesbury (Mass.) Electric Light Company, has been appointed manager of the Merrimac Valley Power & Buildings Company, owners of the Hamilton Woolen Company's plant in Newburyport, Mass. The Merrimac Valley company and the Amesbury company are both controlled by C. D. Parker & Company of Boston, Mass. Mr. Sawyer is to hold the two separate positions, with offices at each place. He entered the employ of the Amesbury Electric Light Company twenty-six years ago.

THOMAS CHANDLER

Thomas Chandler, the president-elect of the Michigan Section of the National Electric Light Association, was graduated from the University of Michigan in 1910. Upon leaving college he was made superintendent of the Edison Sault Electric Company of Sault Ste. Marie, Mich., of which William Chandler has long been vice-president. In 1915 the younger Mr. Chandler was advanced to the position of vice-president and superintendent. He served the Michigan association last year as its vice-president.

E. F. Blaine of Seattle, Wash., has been appointed a member of the Public Service Commission of Washington, to take the place of Charles A. Reynolds, who recently resigned.

L. M. Levinson, for the past year general manager of the Bryan & College Interurban Railway, Bryan, Tex., has been elected also general manager of the Bryan & Central Texas Interurban Railway. Mr. Levinson will have charge of both properties, with headquarters at Bryan.

Francis C. Shenehon, for the last seven years dean of the college of engineering and professor of civil engineering at the University of Minnesota, has tendered his resignation to the Board of Regents. Mr. Shenehon will devote his entire time to his practice as a consulting hydraulic engineer.

Allan R. Gilchrist, for the past ten years city engineer of Montgomery, Ala., has been engaged by the Alabama Power Company of Birmingham, Ala., to act as chief engineer on the construction of a large dam and hydroelectric plant, developing the power of the Warrior River at an estimated cost of $1,000,000.

Barry Dibble has been appointed project manager of the Minidoka Project (Idaho) of the U. S. Reclamation Service with offices at Rupert, Idaho. Mr. Dibble will continue to act as electrical engineer for this project, which has a large electrical installation used for pumping to 50,000 acres of high lands in the Snake River valley. Prior to entering the Reclamation Service in 1909 Mr. Dibble had been engaged in public utility work, including the fields of electric railways, lighting and power and steam and hydroelectric developments.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Small Industrial Oil Switch

The switch here illustrated is used for starting and protecting three-phase induction motors with ratings up to 10 hp. and 600 volts. It conforms strictly to safety-first principles, the manufacturer points out, and consists of but few operating parts, these parts being supported from the switch frame which can be mounted on any flat vertical surface, such as a wall or post, or by supports on the motor-driven machines which the switch controls. All operating or live parts, with the exception of the switch handle, are inclosed. The contacts are under oil and the terminals are in the interior of the frame, which is provided with a tight-fitting, sheet-steel cover.

The switch is built non-automatic, and is provided with two-coil series overload time limit trip, plain low-voltage release, and combined low-voltage and overload protective plugs. All switches of the type shown are arranged for either open or conduit wiring. They open by gravity assisted by torsion springs, and have a quick downward double break per phase. The mechanism is accurately constructed, it is asserted, and parts are interchangeable. "On" and "off" on the frame indicate whether the switch is open or closed.

The energy-carrying parts are liberally proportioned to secure low-temperature rise and long life. The switch studs and movable contacts are mounted in a porcelain block and separated by porcelain barriers. Contacts, terminals,

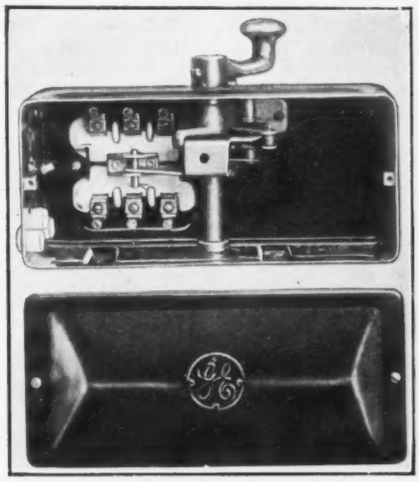


FIG. 1—TRIPLE-POLE, SINGLE-THROW NON-AUTOMATIC SWITCH

etc., are securely held in place by lock washers, preventing loosening from vibration. Stationary contacts consist of drop-forged fingers with flared ends. The movable contacts are copper strips bent to the form illustrated. This construction is said to insure good contact under strong pressure when the switch is closed. The oil tank is pressed from a single piece of sheet steel. A line indicates the depth to which the tank should be filled. The non-automatic switch is held closed by a latch. In opening, the handle is moved some distance before the latch releases, after which the contacts are rapidly snapped open. The automatic switch with two-coil series overload time-limit trip is opened automatically on overload by a trip-coil plunger. The switch cannot be held closed on overload or short-circuit.

Overload trip setting can be varied between the normal current rating of the trip coil and twice normal by a calibrating device in the tube surrounding

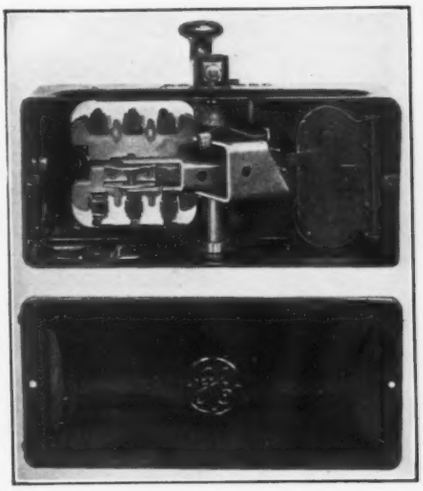


FIG. 2—SWITCH WITH DOUBLE SERIES TIME-LIMIT OVERLOAD TRIP

the lower portion of each trip-coil plunger. After a current setting is made, the device is locked in position by a set screw. Each trip coil is individually calibrated and the tube is then marked in legible white numerals on the black background of the tube.

For time delay in automatically opening the circuit, each overload trip coil is equipped with an inverse time-limit attachment consisting of an oil dashpot connected to the tripping plunger. The time setting is accomplished without removing the dashpot from the calibrating tube. At proper setting, protection is afforded to the motor against overload and against running single-phase, but at the same time prevents the switch from opening while the motor is starting.

The calibrating tubes and oil dashpots are protected from injury by a sheet-steel case attached to the switch frame, which also prevents dust or lint collecting in the tubes. The switch with low-voltage trip is tripped out instantly by a low-voltage release if the line voltage falls to approximately 50 per cent of normal. To reduce the energy loss in the low-voltage trip to a minimum, a small auto-transformer is used in con-

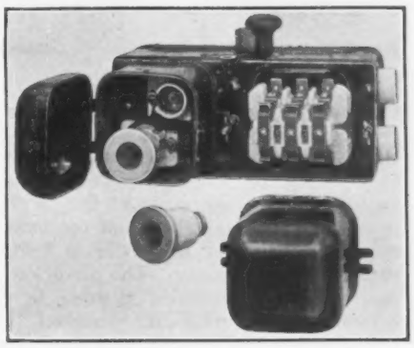


FIG. 3—SWITCH WITH LOW VOLTAGE RELEASE AND OVERLOAD PROTECTIVE PLUGS

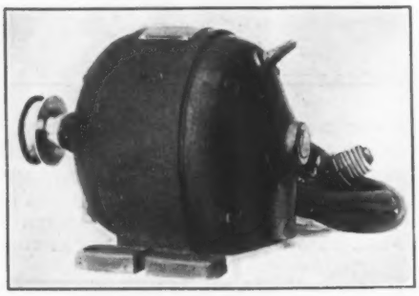
junction with the low voltage release coil except at 110 volts 60 cycles and 40 cycles, where the transformer is not necessary. The switch with overload protective plugs and low-voltage trip is similar to the switch just described, but is equipped also with time-limit overload protective plugs connected in series with the switch leads. The operation of the protective plugs as regards overload and time delay is much the same as that of the inverse time-limit overload trip coils.

The oil switches are known as Type F, Form P-10 devices and are being manufactured by the General Electric Company, Schenectady, N. Y.

Splash-Proof Motors

A line of small alternating-current motors that are splash-proof and known as type CAH machines, has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These motors are particularly adapted for use on washing machines, dish washers, water pumps, etc. As will be seen from the accompanying illustrations, the frames of these motors are so constructed that it is practically impossible for water to get into the motor. Forced ventilation, along the same lines as that successfully used in turbo-generator design, is obtained by a small blower and ample ducts, fully protected from liquids and small objects. Thus the frames keep the motors dry and the fans keep them cool, it is pointed out, under all operating conditions. There are no exposed electrical con-

tacts, connections being made through cable or binding posts fully insulated against accidental shock. There are no rotating electrical contacts or brushes, thus decreasing renewals and the

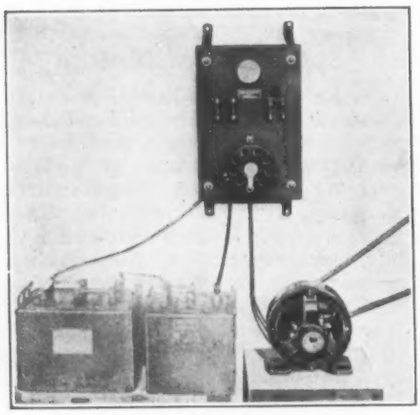


SMALL MOTOR FOR WASHING-MACHINE DRIVE

amount of attention required. Starting is accomplished by means of a switch that is frictionless except at the instant of opening or closing, making wear negligible. The operation of the switch is snappy, it is asserted, and the break quick. Lubrication is furnished by oil cups of large capacity. The motors are cool running, compact, sturdy, light, reliable, simple and easily operated, the manufacturer points out, and they possess a high starting effort, have ample turning effect to overcome peak load, and are of high efficiency and power factor. They may be arranged for side or inverted mounting by rotating the end brackets, and are provided with slotted feet for two-point mounting in addition to holes for four holding-down bolts. Direct-current motors can be furnished mechanically interchangeable with the alternating-current motors. Either a Hubbell plug and 10 ft. of reinforced cable, or insulated binding posts are furnished with each motor.

Small Battery Charging Set

The Main Electric Manufacturing Company, 500 Aiken Avenue, Pittsburgh, Pa., has recently brought out a

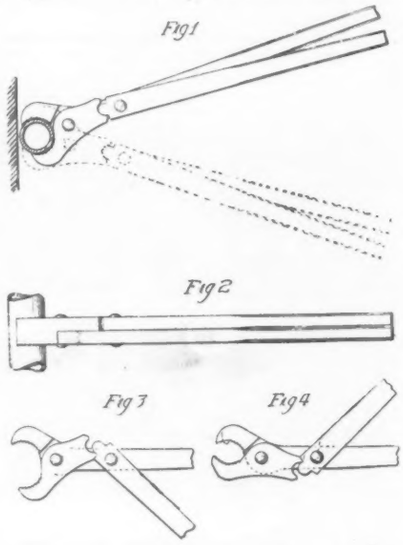


BELT-DRIVEN CHARGING SET

small charging set which is illustrated herewith and which operates from a line shaft or gas engine. The set consists of a small generator which is operated by belt drive and a small charging board of slate having mounted on it a double-reading ammeter, knife switch, fuses, and regulating rheostat. It is especially well adapted for use in small garages where central station energy is not available or where lineshafts are in operation. The set is designed to charge from one to five 6-volt batteries, two 12-volt and one 18-volt battery, one 6-volt and two 12-volt batteries, one 18-volt and one 12-volt battery, or one 6-volt and one 24-volt battery at a time. The range of voltages is such as to accommodate batteries of any description which do not exceed 30 volts. The generator is rated at 300 watts, and is furnished complete with switchboard and proper leads.

Conduit Wrench

In the accompanying illustration is shown a wrench designed for use in pipe and conduit work where the clearances are limited. It is particularly well adapted for pipe work against walls, as shown in Fig. 1, nested pipe and conduit work within walls. The tool, which is known as the "La Rock Wrench," is



CONDUIT WRENCH WITHOUT RATCHET

simple in construction, and is made up of only three parts. No screws, springs, pins or ratchets are used, the absence of which makes adjustment unnecessary, the manufacturer points out. The jaws of the wrench are always in a position, it is declared, to do pipe work. Fig. 1 shows the rotary movement of the wrench with the pipe close to the wall. Fig. 2 shows a side view of the wrench on section of pipe. The wrench is not a tool that will fit all sizes of pipe, but a wrench that will fit the size it is made for in almost all places where other wrenches will not work in, it is claimed, and take hold. Although the wrench is designed for one size of pipe only, and will do the best work on the size marked on the wrench, it is not limited for work on one size of pipe. For example, an 0.75-in. wrench will grip 0.375-in., 0.5-in., and 0.75-in. pipe. The difference in the grip on the 0.375-in. and 0.5-in. pipe is made by the change from the circle and the position of the handles. The wrench is made of high-grade drop-forged steel with special steel rivets, and is being placed on the market by the Mechanical Specialties Company, Peoples Gas Building, Chicago, Ill.

Ball Bearings for Control Motor-Generator Sets on Electric Locomotives

An interesting application of ball bearings is that employed on the control motor-generator sets for the new

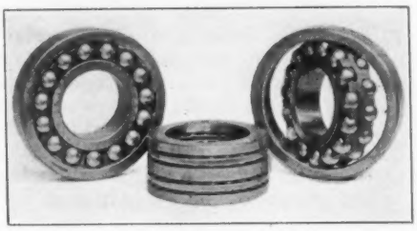


FIG. 1—BALL BEARINGS FOR ELECTRIC LOCOMOTIVE MOTOR-GENERATOR SET

electric locomotives of the Chicago, Milwaukee & St. Paul Railroad. In order to assure absolute safety in operation and to obtain the highest possible efficiency, it was necessary to secure a bearing which would operate successfully under extreme weather conditions, such as very high temperatures in summer and temperatures as low as 40 deg. Fahr. below zero in winter.

The size and construction of the bearings are well indicated in Fig. 1, which shows two radial and one double-thrust bearing. In the center of the illustration is shown a thrust bearing which takes up the shocks incident to switching and train handling. On the left is one of the radial bearings which is more than 10 in. in diameter and has a bore of 4.7 in. On the right, the radial bearing is shown in a deflected position. This deflected view indicates the principle of self-alignment which, according to the manufacturer of the bearings, the SKF Ball Bearing Company, Hartford, Conn.,

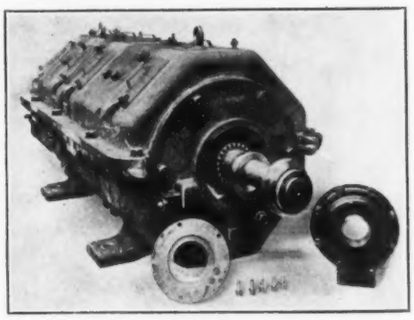


FIG. 2—MOTOR-GENERATOR SET OF ELECTRIC LOCOMOTIVE WITH BEARING CAP REMOVED

was one of the chief reasons for specifying the type of bearings shown.

The bearing consists of an inner race, an outer race and two rows of balls, all of Swedish crucible steel, and a ball retainer of bronze. The inner

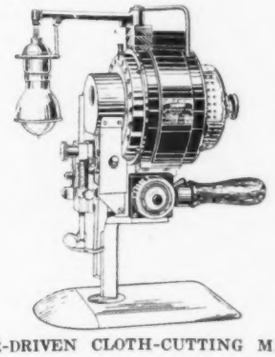
race contains two grooves, each ground to a radius slightly larger than the radius of the balls. The inner surface of the outer race is ground as a section of a hollow sphere whose center is the center of the shaft. The inner race and

FIG. 3—DIAGRAM SHOWING ARRANGEMENT OF BEARINGS ON MOTOR-GENERATOR SETS

the balls and retainer are free to rotate at any angle within the spherical outer race. Thus the bearing will automatically adjust its position to compensate for any shaft deflections or load changes. Fig. 2 shows one of the bearings in place on the set, the bearing cover being removed. In Fig. 3 is shown a diagram which illustrates the arrangement of bearings on the motor-generator set.

Electric Cloth Cutter

In the accompanying illustration is shown a motor-driven machine which is designed particularly for use where large quantities of textile products have to be cut. The electric cloth cutter, as it is called, is a small portable machine driven by a directly connected motor. The device shown in the illustration is an improved type of cutter recently developed by the Eastman Machine Company, Buffalo, N. Y. It is operated by an 0.5-hp. motor, the crankshaft mechanism of which is equipped with roller and ball bearings. A centrifugal feed oiling system is used, oil being forced into the crankshaft bearing every revolution of the motor. All moving parts are inclosed. With direct-current machines, the motor operates at a speed of about 2800 r.p.m. and imparts its motion to the reciprocating knife through a connecting rod, guided by a V-shaped crosshead. The knife reciprocates in a narrow standard made of drop-forged alloy steel that supports the weight of the motor



MOTOR-DRIVEN CLOTH-CUTTING MACHINE

and screws into a plate which passes under the goods to be cut. The goods are held firmly by the presser foot in front of the knife. The presser foot can be readily removed from the machine by pulling back a thumb latch, thus enabling the operator to sharpen the knife without having to reset the presser foot. This presser foot is so constructed that it can be rigidly set or may be arranged to rise or lower of its own accord, when riding over varied thicknesses of goods, by the aid of a spiral spring. The standard in which the knife operates is equipped with removable knife slides, thus insuring long wear to the standard since only the knife slides need be replaced when worn out. Use is made of a solid plate or base with rollers underneath. The snap switch is conveniently placed near the handle of the machine as shown, so that the circuit may be controlled with the same hand that guides the machine. All parts on the machine, the manufacturer points out, are interchangeable. An interesting feature of the machine is the swinging lamp, by means of which all shadows are eliminated.

Transformer for Ford Car Lighting Systems

The steady headlight illumination that Ford drivers always have wanted is available now at low cost, it is declared, by the use of a specially designed transformer, called the "Wayne-

FIG. 1—TRANSFORMER FOR FORD LIGHTING SYSTEM

lite" and developed by the General Electric Company, Schenectady, N. Y. It has been impossible to get this kind of light on the Ford cars as electrically equipped at the factory, it is pointed out, because the current supplied by the magneto naturally varies with the motor speed, and not until a speed of approximately 12 miles per hour was attained was the light really useful. With the higher speeds the illumination was unnecessarily bright, lamps were frequently burned out and their lives shortened. The "Waynelite" is a small transformer, which receives energy from the magneto included in the motor and delivers energy to the headlamps which are wired in multiple instead of in series as in the Ford factory practice. With the series wiring, if either lamp fails, both go out, it is pointed out, to the drivers' annoyance and perhaps peril. This is prevented by the multiple wiring of the "Waynelite" method Tests show that the transformer furnishes a good light at engine speeds corresponding to 10 miles per hour, and above that there is a clear, steady light.

Installation is said to be simple. The only changes from "standard equipment" of the Ford are adding the transformer, partial rewiring and substitution of 6-volt lamps for those of 9 volts

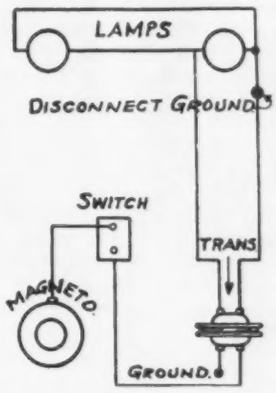


FIG. 2—WIRING DIAGRAM FOR FORD LIGHTING SYSTEM

supplied on the Ford cars. From the magneto to the switch the wiring is unchanged. At the switch the regular headlamp wire is attached to one of the "magneto terminals" of the transformer while the other "magneto terminal" is grounded to the engine frame. A pair of wires lead from the two terminals on the "lamp side" of the transformer. Each wire is connected to one side of each headlamp which are thus rewired in multiple to assure the convenience and safety of practically continuous light. The overall dimensions of the device are 3.75 in. wide, 3.25 in. high and 4.25 in. deep. As it is practically waterproof it may be placed on the dash or under the hood or floor boards with perfect assurance that it will operate, it is claimed, at all times desired.

Electrically Operated Remote-Control Switch

The Type R, Form C, electrically operated remote-control switch, shown herewith is designed especially for central control of lighting circuits and control of motors not subject to heavy overloads and other electrical apparatus located at a distance from the controlling button or buttons. The switch is particularly advantageous for use in moving picture and other theaters,

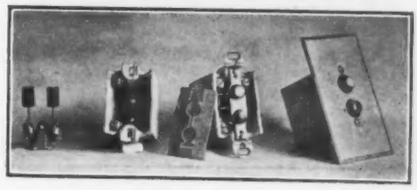


FIG. 1—EXPLODED VIEW OF CARBON BREAK PUSH-BUTTON SWITCH

halls, stores, libraries and like places where centralized control for light work is desirable. As this particular switch takes care of loads too heavy for the ordinary snap switch, it is widely used in installations such as those in the

New York State Educational Building at Albany, N. Y., the new office buildings of the Bankers' Trust Company, New York City, and the Prudential Life Buildings in Newark, N. J., where it has already proved very efficient, it is declared.

Control may be centered in one special push-button switch or in different locations by the use of a number of these push buttons, wired in multiple. This special control button operates at finger pressure and sends current through the two solenoid coils on the switch only at the moment of opening or closing. It is a single-pole, double-throw specially designed push button and is normally in the open position. It remains closed only when held so by the operator. One such switch with escutheon plate ready for wall mounting is furnished as part of the full equipment and must be used since the solenoid coils are not intended to carry current continuously. Little current is used for operation. One coil opens the switch and the other closes it. This approximates on direct current 1.6 amp. at 110 volts and 0.81 amp. at 220 volts, and on alternating current of 60 cycles, 10 amp. at 110 volts and 6 amp. at 220 volts. The device is made specially for use on currents of the above voltages. There is also an insulated handle on the switch for manual operation.

The switch itself is a self-contained unit with two sets of contacts. The main set is provided with special laminated copper brushes that make an "end-on" contact with the switch blade with no tendency to force the laminations apart. The cross-section of the brushes is correct for the current it is designed to carry and its arrangement permits a firm, strong, closing contact,

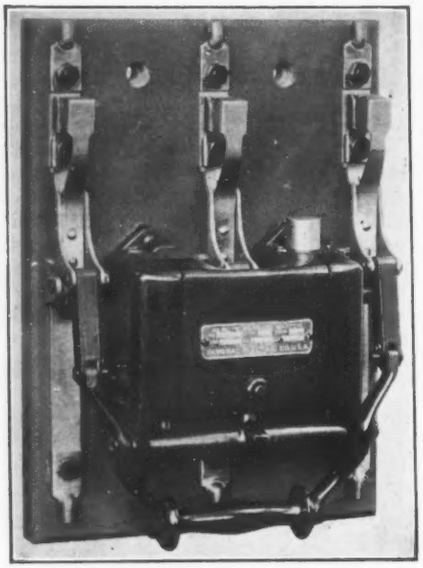


FIG. 2—TRIPLE-POLE 100-AMP., 250-VOLT ALTERNATING-CURRENT OR DIRECT-CURRENT SWITCH

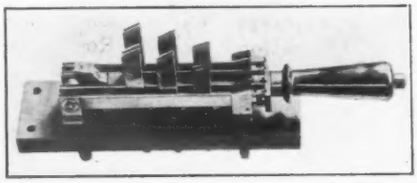
it is pointed out. The contact surfaces are kept bright and a good contact is assured by the wiping effect given the contacts every time the switch is closed. The secondary set of contacts takes the arc on breaking the current. They are of blocks of selected carbon fastened without screws or bolts to flat phosphor-bronze strips, shaped into holders at their upper ends. The switch may be a single-throw, single-pole, double-pole or triple-pole device, and is simple and durable in construction, it is claimed. The temperature of the switch will not rise more than 30 deg. C. above that of the surrounding air provided the leads to which the switch is connected do not heat above that point. The General Electric Company, Schenectady, is making the switch.

Wood Pole Reinforcing

Attention has been called to the fact that the statement in the June 10 issue of ELECTRICAL WORLD, page 1378, to the effect that "the Kootenia Power Company, Ltd., of Coeur d'Alene, Idaho, has applied the Harding Concreting Process to 500 poles at an average cost of $16.50" should have read "at an average cost of $6.50."

Motor-Starting Knife Switches

To provide a simple and inexpensive method of starting rotary converters from the direct-current end and direct-current motors of large capacity having starting conditions that will permit cutting out the starting resistance in four steps, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a line of motor-starting knife switches of which the one illustrated is typical. The



KNIFE SWITCH FOR STARTING DIRECT-CURRENT MOTORS

switches are designed for use on circuits with pressures up to 600 volts, and are made in two types for starting currents of from 300 amp. to 3600 amp. They are intended for starting conditions only, being rated in terms of the starting current. They will, however, carry one-fourth their rated current continuously. Unless the full-load current is only one-fourth of the starting current rating, a short-circuiting line switch or circuit breaker should be used to carry the running load.

These motor-starting switches have four sets of contacts of such length that the switch blade makes contact with each set in succession. Each switch has four blades, a construction that allows ample ventilation and reduces the depth of the switch from the switchboard. To prevent large machines from being started too quickly by throwing the switch through all the positions without stopping on any one position, a ratchet device is provided on the switches for starting capacities of from 1200 amp. to 3600 amp. This device has a stop for each position, and it is necessary to release this stop before passing to the next position, thus insuring that the machine being started has time to accelerate as the resistance is cut out. The switches are furnished with terminal lugs and are arranged for mounting on panels 1.25 in. to 2 in. thick.

Electric Vacuum Cleaner

An all-steel-case vacuum cleaner has recently been placed on the market by the Hotpoint Electric Heating Company of Ontario, Cal. Though made of pressed steel, the cleaner loses none of the so-called flowing lines typical of the ordinary cast aluminum case, the manufacturer points out, and its nickel finish does not discolor light-colored rugs or fabrics. Attention is also directed by the maker to the fact that the pressed-steel case permits interior surfaces being made smooth, thus doing away with the possibility of lint or dirt clinging to the surfaces. The case is strong and durable. The cleaner is equipped with an air-cooled motor, air being drawn into the top of the motor housing, passing through the armature and out at the lower edge of the housing; contact brushes are thus kept free from dirt, it is claimed, lubricating troubles are eliminated, ease of operation assured and life of the cleaner lengthened. Other notable features as pointed out by the Hotpoint company are the large fan made of pressed steel, the pear-shaped handle grip which fits the palm of the hand, the locking device on the handle which keeps the handle in any desired position, the self-adjusting stationary brush and adjustable rear roller which makes it an easy matter to keep the suction nozzle at the proper distance from the nap of the carpet or bare floor. The floor wheels are equipped with all-rubber tires which will not mar polished surfaces. Use is also made of a double-lined dust bag which can be quickly removed for emptying.

VACUUM CLEANER

Pressure Regulator

In the ELECTRICAL WORLD of June 17, page 1433, there appeared an article entitled "Pressure Regulator." In this article it was stated that the device described is being made by the Westinghouse Company. This is an error, as the device is being placed on the market by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

CONVENTION OF OHIO ENGINEERS

Operating Topics and Rates Discussed by Ohio Society of Mechanical, Electrical & Steam Engineers at Cleveland Meeting

The regular semi-annual convention of the Ohio Society of Mechanical, Electrical & Steam Engineers was held in the Hotel Statler, Cleveland, on June 22 and 23. Aside from a paper on rates for electricity presented by F. W. Ballard, the papers dealt with power-plant and operating problems. There was some discussion on merging the society with the Ohio Society of Engineers, and also of holding only one meeting a year hereafter. These matters were referred to committees, to be acted on at the next meeting.

In the absence of the author, E. G. Bailey, the paper on "Measuring Water with a Weir Meter" was read by Prof. F. E. Sanborn. It dealt largely with the construction of the V-notch weir and the manner of maintaining a steady flow with varying height of head.

C. B. Rowley of the Johns-Manville Company made an extemporaneous address on pipe-line insulations for various purposes. He gave particular attention to molded and built-up insulations and their particular adaptation as coverings for steam and cold-water pipes, as well as for boiler coverings and refrigerator construction.

President Joseph L. Skeldon of Toledo gave a very interesting talk on specifications as they are presented to contractors by engineers. In asking bids on a recent contract he added to the specifications the suggestion that if they conflict with the standards adopted by the manufacturer he would be pleased to receive alternate propositions. This, he said, resulted in a very satisfactory contract, although the specifications offered by the manufacturers in this particular case did not differ materially from his own. It is always possible to secure excellent suggestions in this way, he said, and if the manufacturers' standards are used wherever possible it will be found that economy will result. Engineers who specify the same things on every job fail to get the latest ideas in some instances, and are compelled to pay more for the work. It is a good financial proposition to hold as close to the manufacturers' standards as possible. A number of the members agreed with Mr. Skeldon on this matter, and it is probable that the subject will receive further attention at future meetings.

MAKING ELECTRIC RATES

The first address on Friday was made by F. W. Ballard, consulting engineer, on "Making Electric Rates." He explained first the course taken by public utilities commissions in securing data for rate-making purposes. The greatest stress is generally placed upon the valuation of properties, Mr. Ballard said, but he asserted that too little attention is paid to the cost of operation or what the cost ought to be. Usually the commissions take the figures given them by the companies, but Mr. Ballard believes this item should receive closer consideration, and should be one of the important factors in making rates. He also touched on overheads in their relation to fixed charges, and discussed schedules, but did not go into detail as to how they should be made. He did indicate his objections to charging domestic consumers high rates for service and allowing low rates to the larger consumers, and also indicated his objections to rate schemes which charge a high price on the first few kilowatt-hours and a low charge on the remainder.

"The Use of Powdered Coal" was the subject of a very instructive paper read by Joseph Harrington, advisory engineer, Chicago. After giving some idea of the pulverizing machines used to reduce coal to the condition necessary for the combination of coal dust and air that is used in this system, Mr. Harrington discussed the results obtained in iron melting furnaces, annealing furnaces, core ovens, steel furnaces and locomotive furnaces. Mr. Harrington, however, said that the advantages of applying powdered coal to steam generation are the least promising of any in the field of heat, because of the good results now obtained from the use of stokers, and also because of the cost of preparing the coal.

H. H. Magdsick of the National Lamp Works discussed the various systems of modern electrical illumination. He discussed methods of avoiding glare and of securing color quality by the use of light similar to daylight.

The annual meeting will be held on the third Thursday in November, but the place of meeting was left to the council for decision. President Skeldon, Secretary Sanborn and others urged a large attendance at the annual convention.

A. C. Rogers presented a motion, to be voted upon at the annual convention, that the society hold but one meeting a year hereafter. On motion of C. F. Rabbe, a committee of three members will be appointed to consider the advisability of merging the organization with the Ohio Society of Engineers. Judging from the discussion of this motion, there will be strong opposition to this plan.

Federation of Research Agencies for National Defense

The Engineering Foundation, the initial endowment of which was received last year from Ambrose Swasey of Cleveland and is administered in the interest of scientific research and the good of mankind through the engineering profession by trustees from the national societies of electrical, mining and mechanical engineers, held a meeting last week at the University Club, New York, at which it was decided to offer the services of the Foundation to the National Academy of Sciences of the United States to accomplish the federation of all the research agencies of the nation, governmental, university and private, with the object of encouraging the application of scientific principles to American industries and the employment of science in the national defense, which the possibility of war renders particularly important at this time.

The meeting decided to spend from $8,000 to $15,000 per year on a competent executive secretary to assist in the above organization. An important addition to the financial resources of the Foundation was announced from Ambrose Swasey, who was a guest of honor.

Michigan Section of the N. E. L. A. Elects Officers

At the close of the fifth annual convention of the Michigan Section of the National Electric Light Association, held on board the SS. Arizona during a cruise on the Great Lakes, from June 18 to 23, as noted in these columns last week, the following officers of the association were elected for 1916: President, Thomas Chandler, Sault Ste. Marie; first vice-president, W. M. Lewis, Muskegon; second vice-president, J. E. Stanton, Belding; secretary-treasurer, Herbert Silvester, Rochester; executive committee: S. A. Freshney, Grand Rapids; H. A. Fee, Adrian; John A. Cavanaugh, Benton Harbor; Robert H. Hemphill, Detroit, and Howard Pett, Big Rapids.

At the association's executive session it was decidedly the sense of the members present that next year's convention be made the occasion for another boat trip.

In his presidential address presented earlier in the convention, S. A. Freshney of Grand Rapids spoke of the movement now on foot to form a Great Lakes Section of the N.E.L.A. by uniting the Michigan Section with the Wisconsin Electrical Association. While no definite action has yet been taken in this direction, President Freshney recommended that the effort be continued, and expressed the hope that the plan would succeed.

Engineers for Development of Nation's Water-Power

The Joint Conference Committee of National Engineering Societies at its meeting held on June 15 adopted the following resolution:

"The Joint Conference Committee of National Engineering Societies believes that the development of the country's undeveloped water-power will increase national prosperity; that private enterprise should be encouraged and stimulated to expedite such development; that unnecessary legal burdens should be removed and existing doubts as to the safety of investment eliminated. It commends to the support of engineers all efforts made to secure the fullest publicity as to the underlying facts regarding this subject."

Public Service Commission News

New Jersey Commission

In the capitalization of water-power the public must have the advantage, it was pointed out by the Board of Public Utility Commissioners, in regard to the Ocean County Electric Company. In its decision the commission said in part: "The board is inclined to be conservative in allowing value for the water-power. It is not unusual to arrive at the value of water-powers by comparing the operating cost of steam plants and hydroelectric plants, and in this way arrive at the saving in the cost of production in one plant as compared with the other. The amount of savings capitalized on a reasonable basis would represent the maximum value which the water power could have, or, in other words, would represent the maximum basis which would justify the development of a water-power.

"Projects, such as this, which involve the harnessing of natural resources, should be capitalized so that the public secures advantage, and the promoters should be allowed such sum for the collocation of the water-power as reasonably represents a return for vision and enterprise. Of such values, so ascertained, the promoters cannot alone have the advantage. The general public must be permitted to share in it. Any other rule would result in imposing upon the public the necessity of paying rates upon the cost of the more expensive method of power development, though the less costly method was employed."

New York Commission

Following statements by Charles Hickey, attorney for civic organizations of Lockport and associated with the corporation counsel's office of that city, that the Public Service Commission for the Second District had properly decided the Lockport Light, Heat & Power Company rate case in the first instance upon the record before it, but that the city had not properly understood the import of the schedules which it agreed to accept, the commission ordered the case reopened. Hearings will be held at Lockport beginning on a date to be later determined. Commissioner Van Santvoord made it plain in announcing the commission's decision that it did not believe there had been any attempt at misrepresentation on the part of the company with regard to the schedules. Representatives of the company asserted that the persons who made affidavits that the general manager of the company had told them there would be no increase in rates under the proposed schedule had misunderstood the technical details of these schedules. A report of the commission's decision authorizing the change in rates will be found in the ELECTRICAL WORLD for Oct. 16, 1915, page 888.

Colorado Commission

A formal hearing on rules establishing standards of service for all electric, water and gas utilities in Colorado now under consideration by the State Public Utilities Commission will be held on July 7.

One of the new rules provides that "free service in connections must be made wherever the wires or mains of the utility corporation are easily accessible from the property to be connected," while "in other cases extensions must be made where not to exceed 75 ft. of extension to each consumer to be served is required." "In case of extension in excess of this being sought, the commission shall investigate and decide whether they shall be made and under what terms and conditions."

Another rule states that "deposits on meters shall not exceed the amount of a sixty-day bill of a customer, and the company must pay 6 per cent interest annually, or upon the return of the deposit when the service is discontinued."

A check can be had by the consumer under a rule that service meters must indicate clearly, and in such manner that consumers can understand them, the cubic feet, kilowatt-hours, gallons or units of service for which charge is made, and record cards showing the date of each reading and the total registration of the meter on such date must be installed on each meter.

The formulation of these rules, which vitally affect Colorado's public utility corporations supplying metered service, has been accomplished after a year's work and investigation.

In connection with this order, the commission plans to establish a standardizing laboratory at the University of Colorado to be utilized in testing and checking apparatus owned and used by the commission and the utility corporations in testing meters and the products of the utilities. In addition, each utility will be required to provide and maintain a laboratory, meter testing shop and other facilities and equipment for making the tests required by the rules. The apparatus for these shops will be approved, checked and tested by and under the jurisdiction of the commission.

Another New Bulletin.—The employees of the New Orleans Railway & Light Company recently started the publication of a monthly bulletin devoted to reporting the activities of those in the employ of the company. The new publication is entitled *Energy*.

Boost Tax Values of Ohio Utilities.—Taxable values of almost 200 electric light companies, eight water transportation companies and thirty-seven waterworks companies in Ohio, as listed for taxation this year, have been increased $5,475,370 by the State tax commission. The total increase over 1915 is $4,927,180. The aggregate valuation of 1916 is fixed at $40,774,220 and for 1915 it was $35,847,040.

Hot Springs Plant Damaged by Cyclone in Service Nine Hours Later.—The Citizen Electric Company, a subsidiary property of the Federal Light & Traction Company, was severely damaged by a cyclone at 3.05 p. m. on June 5. By midnight of the same day service had been restored. The local paper in commenting on this service, said: "'Service Always,' the slogan of the company, was adhered to as quickly and efficiently as conditions would permit."

Lag in Radio Time Signals Received on the Isthmus of Panama.—The United States Naval Observatory has determined that for the Isthmus of Panama the lag of the Arlington time signal is about .02 second, and that of the Key West radio signal is 0.27 second, the latter being due to the various relays in the commercial telegraph lines over which the signal passes from the Naval Observatory. The error of the time signal sent out from the radio stations is generally less than 0.1 second.

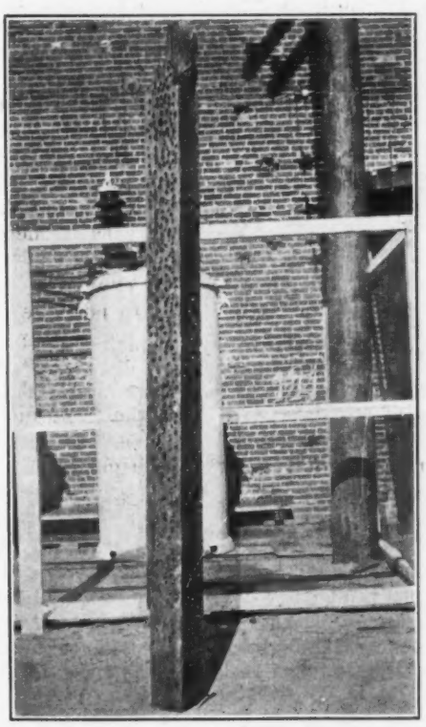
Baltimore Company Announces Sick and Death Benefit Plan.—One of the features of the celebration of the American Gas Centenary in Baltimore June 16 and 17 was the announcement by President Wagner of the Consolidated Gas, Electric Light & Power Company of a sick and death benefit plan which takes into equal consideration the laborer who works for so much an hour and the officer who works for so much a year. The plan incorporates the following features: No employee of the company will be put to an expense of any kind. After six months' employment to those paid by the week, semimonth or month, and after one year's employment to those paid by the hour or day, half-pay will be given during illness for not more than nine weeks. After three years' employment, three-quarters pay for not more than eighteen weeks. After five years' employment, full pay for not more than six months. The death benefit feature provides that $100 will be paid the families of those who die after one year's service, $200 to the families of those who die after three years' service, and $300 to the families of those who die after five years' service. In addition, a medical examiner will be assigned as a regular official of the company, whose duty it will be to see that the employees are kept in good health and are working under sanitary conditions; to give advice and to make examinations in case of sickness. Visiting trained nurse service will also be used. Physical examination will be made of all new employees as a condition of employment.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Louisville Franchise Tax Assessment Increased.—Assessment of the franchise of the Louisville (Ky.) Gas & Electric Company for taxation has been fixed at $10,841,492 by the Kentucky board of valuation and assessment. This is an increase of $2,458,696 over last year's assessment.

Birds Destroy Power Line Pole.—A redwood pole on the Hanford line of the San Joaquin Light & Power Company in southern California recently had to be replaced because of the activity of the birds in using it as a storehouse for winter food. The accompanying illustration shows a section of the pole which contained many hundreds of acorns. This particular pole had been in service seventeen years. The base had been oiled but the part above ground was untreated. It should be explained in connection with this that only poles of soft wood, which have long been exposed to the weather, are attacked in this way, and then only rarely to an extent that makes trouble for the power companies. By far the greater portion of the damage is done by woodpeckers ,although two or three other kinds of birds native to California sometimes attack wooden poles.



REDWOOD POLE DESTROYED BY BIRDS

Small Supply Depots Maintained by Transmission Company to Facilitate Repairs.—In order to effect quick repairs the Illinois Traction Company keeps stored in small quantities at more or less regular intervals along its lines supplies of cross-arms, line hardware, insulators and other material used for repairs. The storage points are laid out so that, as a rule, any break that occurs will be within three or four miles of one of these miniature supply depots.

Birmingham May Try to Get Taxes from Alabama Power.—The city of Birmingham is reported as investigating the right of the Alabama Power Company to maintain sales offices and warehouses in that city without paying any license. City Attorney Ullman has been instructed to examine into the legal rights of the city in regard to this. It has been stated that the power company had no right to maintain sales offices and warehouses without paying a license. An attempt, it is believed, will be made to collect a license of 2 per cent on the gross business done in Birmingham by the company, including $11,000 computed on this basis, due from last year.

Industrial Heating Papers Before Gas Society.—B. R. Laraway of Jackson, Mich., president of the Michigan Gas Association and a member of the Michigan section of the National Electric Light Association, announced at the convention of the latter society that the program of the Michigan Gas Association's convention at Detroit on Sept. 21 and 22, 1916, would contain the following papers: "Gas Versus Electricity for Enameling," "The Community and the Utility" by the secretary of the Michigan Railroad Commission, and "Heat Treating and Its Effect on Metals." These papers, said Mr. Laraway, are all of interest to electric utility men and it is hoped that as many as can will attend the fall convention of the Michigan Gas Association.

Memphis Declines Rate and Merger Offer of Private Plants.—Proposal made jointly by the Merchants' Power Company and the Consolidated Gas & Electric Company of Memphis, Tenn., to reduce rates for electric service, on condition that the city would forego plans for building a municipal plant, and that merger of the two companies be approved, has been declined by the city. The offer, it is stated, was similar to one made previously and comes at a time when the city is reported to have decided not to buy the plant of the Merchants' company, but to erect a new plant. No plans for such a plant have been drawn, although the city officials have some rather elaborate data on the proposition. The proposition was for a reduction from 10 cents per kilowatt-hour to 7.5 cents for the first fifty hours, 6 cents for the second fifty, 5 cents for the third and 4 cents for the fourth. Mayor Ashcroft's objection was that the proffered reduction would be of small benefit to small power consumers or to residence consumers.

Terms of Penal Ordinance Must Be Strictly Construed.—An ordinance providing that wires must not be strung less than a certain height in the clear above any part of the authorized grade of any street, sidewalk, alley or public place within the limits of the city refers only to such streets, alleys, etc., having a grade formally authorized by the city because the ordinance is penal and therefore must be strictly construed, according to the Supreme Court of Washington (157 P. 462), in the case of Clark versus Pacific Power & Light Company. In this case the alley in question while recognized as a public place for many years had not been improved by the city, nor had the city in any way even established there any grade. The ordinance, therefore, did not apply.

Delegation of Rate-Making Power to Cities.—The Legislature has the power to regulate the rates and charge of corporations rendering public service, and, has the power to delegate to cities the right to regulate and fix rates for electricity, and to fix charges for meters, etc., it was held by the Supreme Court of Iowa (157 N. W. 844) in the case of City of Tipton versus Tipton Light & Heating Company. Granted the power to fix rates a city may by ordinance fix a maximum rate, having due regard to the corporation's right to reasonable remuneration for the services rendered, and the reasonableness of its exercise of such power may be inquired into by the courts. The act of a city, thus empowered, in fixing rates to be charged for electric light, is presumed to have been in the proper exercise of the power conferred, and the rate established by its ordinance is presumed to be reasonable, and, if it is attacked as being unreasonable, the only question which the court can consider is whether its enforcement will deprive the corporation of fair compensation.

Contributory Negligence in Case of Fallen Wires.—A marshal of a city, knowing that the energy was shut off of electric light wires and being bound to see that the streets and sidewalks were kept free from dangerous obstructions, and who in attempting to remove from a passageway a broken electric light wire received a shock resulting in his death, the wire having come in contact with a heavily charged power wire, cannot be held a trespasser or meddler in removing the wire, though it was not his duty to do so, it was held by the Springfield Court of Appeals (183 S. W. 1072) in the case of Sprinkles versus the Missouri Public Utilities Company. The act of the deceased in taking hold of an electric light wire was not negligence when he knew that the street lights were not burning and that the current was turned off the light wires in the daytime. Although the deceased was an expert electrician, and although the point of contact between the light wire and the high-power wire was very close to the break in the electric light wire, and although on discovering the break he climbed the pole for some distance, it does not charge him with knowing that the light wire was live.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Power of Public Service Commissions.—The power of a public service commission to alter rates, charges, etc., for public service is delegated legislative power and the procedure in exercise thereof legislative in character, it was held by the Supreme Court of Appeals of West Virginia (88 S. E. 840).

Knowledge of Faulty Condition of Lines by Experienced Linemen Precludes Recovery for Damages.—An experienced lineman who knew the line he was working on was in bad repair, very old and badly insulated and who, had he looked, would have seen that a connection had fallen so as to charge a metal cross-bar which he touched, receiving severe burns, was held by the Supreme Court of Michigan (157 N. W. 70) to have assumed the risk of injury, precluding recovery.

Power of City to Demand Underground Distribution.—The city of Pittsburgh has the power to compel the removal of poles and overhead wires from a street provided the power is exercised in a reasonable manner, it was held by the Supreme Court of Pennsylvania (97 A. 85) in the case of the Duquesne Light Company versus the City of Pittsburgh. Where the overhead wires were operated at such a high voltage as to be dangerous to anyone coming in contact with them and amounted to an obstruction, an ordinance requiring them to be removed and placed in underground conduits was held to be within the power of the city.

Lighting Company Must Provide Against Wires Being Thrown Across Its Lines.—A peculiar case but one that might easily happen to any lighting company using overhead distribution was decided by the Supreme Court of Kansas (157 P. 442) in Snyder versus Leavenworth Light, Heat & Power Company wherein the lighting company was held to be negligent in not providing against accidents caused by children throwing wires across distributing lines. The suit was won by the plaintiff, who looking out of her window discovered a boy in flames and motionless, and when she attempted to put out the flame received a shock. The boy, it seems, had hold of a wire attached to the other end of which was a stone, which had been thrown across the lighting company wires. The lines, it was brought out in the evidence, were of weatherproof wire but had been up so long that the insulation had rotted off. The court pointed out that the throwing of wires across the lighting wires was an act to be anticipated by the company and that in not keeping its wires properly and adequately insulated it was negligent.

"Employee" Within Meaning of Compensation Act.—The word "employee" within the meaning of the workmen's compensation act, it was held by the Court of Appeals of New York (112 N. E. 571) means a person who is engaged in a hazardous employment in the service of an employer carrying on or conducting the same upon the premises or at the plant, or in the course of his employment away from the plant of his employer.

Commission Procedure.—According to the Supreme Court of Appeals of West Virginia (88 S. E. 840) permission given by a public service commission to a utility to increase its rates within maximum limits fixed by its order is not a prescription of a new actual rate, nor can the maximum rate so fixed be collected unless schedules have been filed with the commission and all other technicalities of the law complied with.

Occupational Diseases.—An important point is discussed in the Connecticut Supreme Court of Errors case (97 A. 345) relative to whether an employee is entitled to any recovery, under the workmen's compensation act, for "personal injuries," when such disability is caused by occupational disease contracted in the course of his employment. An award was made to plaintiff for "personal injuries" arising out of and in the course of his employment; he having contracted lead poisoning from the fumes of molten lead around which he was obliged to work. Defendant appealed on the ground that the compensation act was intended to include only such cases of disability as were the result of external violence or internal strain. After reviewing the compensation acts of the different states generally, the court found that none expressly include occupational diseases; that the words "personal injuries" are used without qualification in ten states; that twenty acts limit recovery expressly to accidental injuries, and four positively exclude disease except as it results from injury. It was also found that, in two states where the wording is doubtful as to its scope, the construction placed on it tends to exclude occupational disease. In connection with the Connecticut act the court in its opinion said in part: "It follows that, if we construe the act as covering compensation for death or incapacity arising from occupational disease, we shall introduce into it a most important subject, which, so far as we can ascertain from the public documents, was not considered by the Legislature in this connection. In fact, the economic importance of the inclusion of disease in an act which contains no special provisions on the subject can hardly be estimated. Since the common-law action for damages, which was founded on the employer's negligence, never attempted to cover the typical case of an occupational disease caused by continued exposure to the ordinary and known risks of the employment, the inference is plain that the alternative compensation scheme was not intended to cover such diseases."

Kalamazoo Jovian League Started.—A branch of the Jovians was recently established at Kalamazoo, Mich. L. R. Klose was elected president of the local chapter, John Gemrich, vice-president, and L. W. Brown, secretary and treasurer.

Los Angeles Jovian League.—At the meeting of the Los Angeles Jovian Electric League on June 14 the subject under discussion was "Preparedness" and addresses were made by George S. Patton and Gen. Harrison Gray Otis.

New England Electrical Convention.—The New England Electrical Convention and Exhibition will be held at Governor's Foot Guard Armory, Hartford, Conn., on Sept. 26, 27 and 28. under the auspices of the Electrical Contractors' Association of Connecticut.

Penn Central Branch N. E. L. A.—A meeting of the Penn Central branch of the National Electric Light Association was held at Altoona, Pa., on June 5. J. L. Minich, illuminating engineer for the Pennsylvania Railroad Company, presented a paper on "The Incandescent Lamp."

Institute of Radio Engineers.—A meeting of the Institute of Radio Engineers was held on June 7 at the Engineering Societies Building, New York. Prof. Hidetsugu Yagi of the College of Engineering at Sendai, Japan, read a paper on "Arc Oscillations in Coupled Circuits."

Chicago Electric Club-Jovian League.—The last meeting of the Electric Club-Jovian League of Chicago before the summer vacation was held on June 22. The entertainment was by members of the Chicago Grand Opera Company. The annual picnic will be given later in the summer.

Brooklyn Company Section, N. E. L. A.—The June, 1916, convention of the Brooklyn company section, National Electric Light Association, was held on June 21 at Feltman's, Coney Island. Besides the readings of reports, etc., the members listened to a résumé of the recent Chicago convention of the parent association.

Utah Electric Club.—William H. Edmunds, superintendent of the Denver & Interurban Railroad, delivered an illustrated lecture on "Steam Railroad Electrification" on June 17 in the rooms of the Salt Lake Transportation Club, Salt Lake City, Utah. The lecture was given under the auspices of the Utah Electric Club, the Utah Society of Engineers, the American Society of Engineers and the Salt Lake Transportation Club.

California Contractors & Dealers.—The seventh annual convention of the California Association of Electrical Contractors & Dealers will be held in Stockton on July 14, 15 and 16. The mornings of the first and second day will be devoted to business sessions for members only, the afternoons being joint sessions with central station members. The third day will be taken up by a steamer excursion on the San Joaquin River.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 55 of this number.

Georgia Electrical Contractors.—The Georgia Electrical Contractors' Association will hold its semi-annual meeting at Hotel Tybee, Tybee Island, on July 3 and 4, according to plans announced by Norton Frierson, vice-president of the association.

Lehigh Valley Light & Power Branch, N. E. L. A.—An address on "Preparedness" by Major Frank D. Beary, deputy adjutant-general of Pennsylvania, featured the monthly meeting on June 13 of the Lehigh Valley Light & Power Company branch of the National Electric Light Association. The branch elected an executive committee, composed of the following: T. T. Fogel, A. P. Schneider, B. W. Grosh, I. E. Brown, R. C. Pretz and advisory head, A. H. S. Cantlin.

Chicago Electric Vehicle Section, N. E. L. A.—At the annual meeting of the Chicago electric vehicle section of the National Electric Light Association the following officers were elected: Chairman, George B. Foster of the Commonwealth Edison Company; vice-chairman, W. F. Bauer of the Edison Storage Battery Company; secretary, Carlyle Fliedner, associate editor of *Electric Vehicles*. After the election of officers, the meeting was given over to a general discussion toward "Planning a Greater Electric Vehicle Industry for Chicago and Vicinity." The members will join the Chicago Electric Club-Jovian League in its annual picnic.

Pennsylvania Electrical Contractors' Association.—The fourth annual meeting of the Electrical Contractors' Association of the State of Pennsylvania was held at the Hotel Sterling, Wilkes-Barre, Pa., on June 21 and 22. The first day was confined to business and technical matters. At the open session in the afternoon, Frank E. Hollis, commercial manager of the Wilkes-Barre Company, spoke on "Preparedness and the Contractor." He was followed by George W. Hill of the Society for Electrical Development, whose subject was "Systematized Electrical Boosting." At the annual banquet in the evening the following speeches were delivered, "Electrical Merchandising," by F. W. L. Fullerton, president, Fullerton Electric Company, New York; "The Business of Electrical Inspection," by Washington Devereaux, chief of the electrical department, Philadelphia Fire Underwriters' Association; "The National Electrical Contractors' Association," by George H. Duffield, secretary of the national body, Utica, N. Y. The second day was given over to recreation, closing with a clambake in the afternoon at Hotel Oneonta. The new officers for 1916-1917 are as follows: President, M. E. Arnold of M. E. Arnold & Company, Philadelphia; vice-president, Albert Gentel of Albert Gentel, Inc., Philadelphia; secretary-treasurer, M. G. Sellers, Philadelphia; national director, George E. Shepherd of Shepherd & Rust, Wilkes-Barre, Pa.

Ohio Electric Light Association.—The twenty-second annual convention of the Ohio Electric Light Association will be held at the Breakers Hotel, Cedar Point, Ohio, on July 18, 19, 20 and 21. The first session will be held during the afternoon of the opening day. A discussion on "Street Lighting Contracts" will be opened by the illumination committee, to be followed by a round table on the following executive and public policy subjects: "Legislation Needed by Company and Consumer," by J. C. Martin, Columbus; "Taxation of Public Utilities," by Elam Fisher, Eaton; "System Among Employees as an Adjunct to the Public Policy of the Company," by W. A. Wolls, Columbus; "Municipal Ownership, Its Shades and Shadows," by D. L. Gaskill, Greenville. The second session, to be held on Wednesday morning, will be technical in character. There will be the report of the station operating committee and the report of the transmission and distribution committee. The third session will be held on Wednesday afternoon, when an address on "The Public Policy of a Utility" will be given by W. W. Freeman, president Union Gas & Electric Company, Cincinnati, Ohio, and a paper on "The Missing Link" will be read by E. Burt Fenton, manager department of publicity, W. S. Barstow Company, New York. At the fourth session, on Thursday morning, which will be commercial day, there will be read the report of the new-business co-operation committee, with discussion opened by H. C. Gillie, Cleveland; F. B. Steele, Dayton; W. A. Wadsworth, Cincinnati; L. Beecher, Hillsboro; C. E. Yacol, Youngstown, and a round table on the following commercial topics: "From Barter to Business Through Standardization," by S. E. Doane, Cleveland; "Deposits from Customers," by T. F. Kelly, Dayton; "Financing the Wiring and Fixture Installations for Contractors by the Banks as a Step in Development of an Old House-Wiring Plan That Has Wired More Than 20,000 Old Houses," by M. E. Turner, Cleveland; "Merchandising from a Central Station Standpoint," by A. K. Young, Toledo; "Giving Free Electric Units in Exchange for Gas Arcs," by W. A. Wadsworth, Cincinnati; "Electric Heating," by H. O. Loebell, New York, N. Y.; "New Business Development During the Years 1915 and 1916," by W. A. Wolls, Columbus. At the Thursday afternoon session Henry L. Doherty of New York will deliver an address and R. H. Grant, general manager Domestic Engineering Company, will speak on "A Selling Talk." The final session will be held on Friday morning. Both the meter committee and the committee on standardization of voltages will report. An address on "Jovianism and Its Relation to the Electrical Industry" will be given by Martin J. Wolf, St. Louis.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

THE MARKET IN WATER WHEEL GOVERNORS

Business During Early Months of Year Considerably Above Normal—Deliveries Longer

In contradiction to the general supposition that hydroelectric development is at a standstill pending the action to be taken by Congress regarding water-power legislation manufacturers of water-wheel governors have enjoyed during the first half of the current year quite a large business. One prominent factory, it is known, has been running along at double the volume of business that was carried in 1915.

There seems to be some doubts, however, that this volume of business will be maintained. There is little new development work of a large nature scheduled for the latter part of the year and what work is now in progress has for the most part, it is believed, either been supplied with the necessary governors or contracts have been let. Many large projects for which plans have been laid will not be undertaken until Congress definitely decides the future status of water powers. Doubt is also expressed in some quarters as to whether any of the proposed developments will be undertaken this year even if Congress does pass favorable legislation. With prices of equipment advanced 25 per cent and more, especially for copper wire, which has doubled in price, and with labor commanding 20 per cent more wages, the construction costs of a new hydroelectric system are almost prohibitive.

Not only is it expected that new development will be deferred until lower prices obtain but additions and enlargements to systems and the installation of additional units will undoubtedly be put off as long as possible. In fact, it has been pointed out that the present volume of business is due to desperation on the part of a number of hydroelectric companies which have put off for a year or two making additions which they otherwise would have made in normal times. The companies have either suddenly acquired loads that are taxing present equipment beyond capacity or else it is evident that the increasing loads on their systems demand addtional generating facilities. For such construction work the demand for water-wheel governors has been abnormally large, but this is not regarded as an index of general improvement in business conditions.

There have been some very large single orders, one in particular which has been spoken of as the largest water-wheel governor contract ever closed so far as the number of governors is concerned. This contract calls for seventy-four governors for the development at Sault Ste. Marie of the Michigan Northern Power Company. It is believed that the largest lot of governors ever sold previously for one installation was the series of large canal contracts for the State of New York, which took forty-eight governors.

With the exception of standard machines which are carried in stock, deliveries are much longer than under normal conditions. One prominent manufacturer, who made deliveries in from thirty to sixty days depending on the size and design of the machine, promises deliveries in about six months. This situation has been brought on chiefly by the accumulation of business during the earlier months of the year.

There has been little if any advance in the prices of governors, although labor and raw material have advanced enormously. Manufacturers are endeavoring to offset these higher production costs by economies incident to increased production and in other directions. Prices have not gone soaring as in other lines, it is understood, owing to the stiff competition in the market.

It is believed by some that the tendency of governor prices is downward. This it is felt will be due to standardization of product. At present each manufacturer has a number of types and styles on the market. Under such conditions the volume of sales in any one design must be relatively small. Production costs, of course, are higher than if a large number of a particular design was produced. It is, therefore, thought that standardization with quantity production will cause prices of governors to decline for some time, other things being favorable.

Credits and collections are good. Compared with last year there is very little difficulty in collecting accounts due.

APPLIANCE DEMAND IN NEW YORK

To Meet Conditions Jobbers Must Carry Stocks Double That of Normal Times—More Intelligent Competition

Jobbing business in electrical goods and merchandise in New York City is decidedly abnormal. For some months the demand has been large and has been increasing. There is, however, a sentiment now that the peak is not far away, although a break is by no means anticipated. Rather is it felt that the volume of sales curve will show a flat peak with a gradual sloping off to normal. This belief is held owing to the large amount of building operations going on.

Of all of the many different kinds of material listed by the jobbers perhaps lamp cord and small wire is more in demand than anything else. Sockets, receptacles, etc., are also in heavy demand. Contrary to normal times or times of brisk business the price is not the entire selling point. Far more important to-day is the question of deliveries. A purchaser of a year ago asked for prices, but to-day his first question is about deliveries, after which comes price. No matter how favorable a jobber's price may be, if he cannot make prompt deliveries he is not liable to obtain the order.

For this reason a situation has arisen which has been viewed with some concern by both the jobber and the manufacturer. To meet deliveries the jobber is confronted with the problem of stock. Although manufacturers fell behind frightfully on their deliveries the jobber still had to fill his orders promptly. His stock under ordinary conditions could be completed quickly should there come a run on it. With the present industrial and building activity calling for large quantities of material and with manufacturers unable to furnish it as quickly as wanted, a larger stock is found to be necessary. Jobbers in New York City, therefore, in a large number of cases, are carrying a stock almost twice that of normal times. And until the manufacturer can give quicker deliveries the jobber must continue to keep up this abnormally large stock.

The jobbing business, as is well known, is practically built on deliveries. Fundamentally, the jobber must be able to make deliveries as ordered. The jobber has been forced to anticipate any reasonable demands that may be made on his stock by ordering abnormally large quantities of goods in advance. Freight congestion has held up delivery on many orders and has caused the jobbers to increase their stock a compensating amount. Shipments from the Middle West to New York have been very slow in transit.

Competition, while not so great in the seller's market, is on a better basis in New York City. It is not meant by this that there has been any price agreement or any attempt at price maintenance, but rather that in the last decade the metropolitan jobbers as a class have been educated to a more intelligent kind of competition. The cost of doing business which frequently was lost sight of in the past

in the scramble to get the business is now rarely forgotten.

With the avalanche of business the producer has been forced to raise the price to the jobber and the jobber to the dealer, contractor, etc. For the present, however, it is not thought that prices will go higher. Copper is quoted a few cents lower than the maximum of a few weeks ago and on other raw materials similarly certain concessions in prices are being made.

POLE LINE HARDWARE

With Large Amount of Construction Work in Sight Prospects Are Bright—Prices Higher—Deliveries Longer

Business in pole-line hardware at the present time is considerably above normal. A large amount of construction work that was originally intended to be undertaken many months ago is now going ahead because it is no longer possible to hold back. This work has accumulated and has resulted in flooding the manufacturers with orders. Prospects for the future in this line seem particularly bright. It is known that there is a very large amount of construction work under contemplation, much of which must necessarily be undertaken shortly, and also a large amount that is being held back awaiting more favorable prices, particularly of copper.

Prices have increased considerably owing to the high prices of iron, steel, copper and zinc and also owing to the high wages demanded by labor.

Deliveries are much longer than during normal times. This is principally because of the difficulty of manufacturers in obtaining the raw material. The scarcity of labor, freight congestion and the general swamped conditions of the factories are other items which have held back shipments.

Collections and credits are said to be good. In fact, the class of customers with whom the manufacturers of this material must deal is not one that offers the ordinary credit difficulties.

HEATING DEVICE LICENSES

Permission to Manufacture Granted Under Three Separate Forms According to Volume and Diversity of Business

A large number of manufacturers of electric heating devices employing nickel-chromium as the resistance element have become licensed by the Hoskins Manufacturing Company and the General Electric Company, owners of the Marsh patent, to continue the manufacture of their product. Others are being licensed right along.

There are three forms of licenses under which device manufacturers may operate, the granting of which is dependent upon the manufacturer's volume of business, variety of product and particularly upon his equity in the industry at large. The first form is issued to the large heating device manufacturers who generally cover the whole field. Under this license the manufacturer is unrestricted as to character of devices fabricated or to the volume of business.

The second and third forms restrict the licensees either to special lines of manufacture or to a limited volume of business. These forms are issued to smaller manufacturers and to manufacturers of special devices or only a line or two of heating devices. A very large number of Forms II and III already have been issued and it is expected that there will be many more.

The policy of the Hoskins Manufacturing Company and the General Electric Company with respect to the issuance of licenses is, so far as possible, to grant a right to electric heating device manufacturers to use the patent to the extent to which they have actually developed their business and not to confiscate business. On the other hand, it is recognized that larger concerns which have developed the business broadly are entitled to more favorable terms. The owners of the patent will attempt to recognize the equities of all concerned.

There is nothing in the various licenses limiting the action of the patent owners in their distribution of licenses except that holders of license Form I are placed in a position of securing the most favorable terms. Should the owners of the patent decide to grant to any manufacturer or class of manufacturer a license the terms of which are more favorable than those in Form I, the holders of this license, if they so elect, may choose to operate under the more favorable form of license.

A separate form of license is required of the wire manufacturers. So far but two firms in addition to the Hoskins Manufacturing Company have a right under the patent to manufacture nickel-chromium wire. They are the Driver Harris Wire Company of Harrison, N. J., and the Electrical Alloy Company of Morristown, N. J.

APRIL EXPORTS $2,630,169

Estimated That 1916 Electrical Exports Will Run Considerably More Than $30,000,000

Electrical machinery, appliances, instruments, etc., of American manufacture were exported from United States during April last to the value of $2,630,169, according to the April summary of foreign commerce issued by the Bureau of Foreign and Domestic Commerce. The April, 1915, exports amounted to $2,055,375.

The April, 1916, exports were considerably less than those for either of the two preceding months, but on account of the small January exports they are equal to the average of the first four months of the current year. On the other hand the April, 1915, exports were larger than those for any of the earlier months in 1915, by about $300,000. The April, 1916, figures, therefore, do not compare as favorably with the 1915 figures as do those for earlier months in 1916.

During the first four months of this year the electrical exports totaled up to $10,776,477 in comparison with $7,174,851 for the similar period in 1915. Using the values for the first four months of this year as a basis for calculation, it is estimated that the exports of electrical goods during 1916 will be in the neighborhood of $32,500,000. This figure may be compared with $24,308,510 for 1915; $19,963,115 for 1914, and $28,197,363 for 1913.

Although the April exports were less than those for March and February the month held the record for the year in a number of articles. In fact, had the exports of motors, telephones and miscellaneous appliances been comparable with those of March or February the March figures would have passed the record figures of February.

The April exports of motors amounted to but $272,000, while during the previous months of the year the exports of motors were as follows: January, $389,000; February, $440,000, and March, $474,000. In the same fashion the April exports of telephones were about $130,000 less than those during the month of March. Miscellaneous exports during April were about $130,000 less than during March and more than $275,000 less than during February. On the other hand the April exports of batteries, generators, fans, insulated wire and cable and metal filament lamps were larger than during any previous months in the year. Moreover, for the first time this year the exports of generators have been larger than during the corresponding month of 1915. As a rule the exports of generators have been away below those of last year. The April, 1916, exports of generators were almost 20 per cent greater than those during April, 1915.

Exports of carbon lamps, arc lamps, interior wiring supplies, meters, motors and telephones were less during April than during any of the three preceding months. For the first time this year the exports of interior wiring supplies and carbon lamps were less than the corresponding months of 1915.

As has been pointed out before in the ELECTRICAL WORLD, these figures if taken for their face value have little meaning when compared with the figures for previous years. Prices have advanced to such an extent since last fall that an erroneous opinion would be formed if comparisons are made on the basis of valuation only.

If prices have advanced on an average of 25 per cent, and

this is by no means an unconservative figure, then the 1916 exports are running about the same as in 1915, which is considered less than during the early months of 1914 and 1913.

Articles	April, 1915	April, 1916	Ten Months Ended April, 1915	Ten Months Ended April, 1916
Batteries	$88,372	$168,142	$773,578	$1,252,563
Dynamos or generators	127,071	151,727	1,737,513	1,189,462
Fans	61,926	45,528	181,365	298,370
Insulated wire and cables	354,344	386,239	1,356,574	2,575,002
Interior wiring supplies, etc., including fixtures	67,605	44,805	550,836	743,757
Arc lamps	554	639	27,958	15,998
Carbon filament lamps	27,665	5,410	82,898	130,851
Metal filament lamps	36,936	128,734	352,381	1,007,707
Meters and other measuring instruments	69,835	52,255	331,889	624,200
Motors	193,802	272,261	2,325,806	3,468,843
Telegraph instruments (including wireless apparatus)	14,377	7,965	71,781	123,785
Telephones	89,730	52,064	1,049,929	786,706
Transformers	47,763	68,889	530,723	763,358
All others	875,395	1,245,511	6,551,236	10,685,665
Total	$2,055,375	$2,630,169	$15,922,467	$23,666,267

JAPANESE ACTIVELY AFTER AMERICAN BUSINESS

Oriental Electrical Manufacturers Energetically Pushing Sale of Supplies in This Country

In a letter to the Chicago Association of Commerce, a Japanese manufacturer and export merchant writes that he has received an order for 7,000,000 small lamps from the United States, and that he would like to get some large orders, as the capacity of his factory is very large, and capable of a much greater output. He also makes tumbler switches, sockets, black cotton tape, etc., and is in the American market for large orders on these as well.

This, it is stated, is only an instance of the flood of similar correspondence from Japan coming to this country. Japanese manufacturers of all manner of electrical goods are energetically pushing the sale of their supplies in this country, and give with their communications rather detailed descriptions, etc.; and some even quote prices C.F.I., San Francisco, Seattle, New York and Chicago. Those in close contact with the foreign trade situation say that the American manufacturers little realize the activities and extent of the operations of foreign manufacturers in this country, and particularly Japanese manufacturers, in their endeavor to secure American trade.

WESTERN ELECTRIC SUPPLYING ONLY OLD CUSTOMERS

Salesmen Instructed Not to Solicit Any New Business of Products of Western Electric Manufacture

So serious has the market conditions for raw materials become that the Western Electric Company has found itself forced to issue orders to its salesmen forbidding the solicitation of any new business in products of Western Electric manufacture. This order applies only to the factory salesmen and not to the jobbing salesmen. In the jobbing end of the business it is understood supplies are coming in regularly and the company has made no change in its former policy of soliciting business.

Gerard Swope, vice-president of the Western Electric Company, has issued the following statement in connection with the situation:

"Owing to extraordinary conditions that exist in the raw material market, we are experiencing great difficulty in procuring many kinds of material required by our factory. Unfortunately, we are having greatest difficulty in obtaining the most commonly used materials, such as copper, rod and sheet brass, iron, steel and paper. It will be recognized that these materials enter broadly into all kinds of telephone apparatus and cable.

"Because of these conditions and the unprecedented demand for our products, it is impossible for our factory to keep abreast of the incoming orders. In fact, it has frequently been necessary, of late, to stop work at the factory until further materials were received.

"We are, therefore, not soliciting any business from customers. We shall endeavor, of course, to take care of the demands of our customers who have standardized on our products. We cannot hope, however, to do much more than this under existing conditions. We hope by this action to have and to be able to produce sufficient merchandise to fulfill the demands that will be made upon us. As soon as the situation improves sufficiently to warrant a change in our practice, notice to this effect will be issued promptly."

This order, it is understood, applies to telephone business.

TRADE IN COOKING UTENSILS

Announcement of Advance in Prices Caused Large Volume of Orders in First Half of Year

Volume of sales of electrically heated cooking utensils during the first half of the current year was larger than during the corresponding period of last year. Buying was brisk from all sources. Jobbers have been laying in large stocks. Since manufacturers find it impossible to make as quick deliveries as formerly, jobbers and others who purchase direct from the manufacturer in order to keep up stock must order in larger quantities. Another consideration which it is believed in some quarters has been largely responsible for large orders is the price situation.

Owing to the cost of the raw products on the one hand and to the nickel-chromium patent license requirements on the other, announcements have been made that after a certain date appliances would cost so much more. As a result future requirements were anticipated as far in advance as possible at the lower price.

Just what effect this will have on future sales it is hard to state with assurance. Some manufacturers frankly state that they expect very little of the remainder of the year. They point out that jobbers and dealers took the opportunity offered them to lay in stocks at the lower prices and that their needs, therefore, were adequately provided for for some months to come. Other manufacturers, however, point out that about Oct. 15, the last date at which deliveries can be made under old contracts, there will probably be another advance in price. In order to take advantage of the lower price it is expected that buyers will make further enlargements of their stock.

As stated above, prices have advanced, in some cases as many as three times in the last half year or so. It is doubtful if the royalty requirements of the Hoskings Manufacturing Company and the General Electric Company, have been responsible for much of the advance in price; for it is understood that while the patent owners first decided to ask a large royalty, later negotiations between the owners and the other manufacturers have brought about a decided concession. At the present time the royalties paid on each device are probably so small that slight economies in manufacture would very easily offset this cost. Prices have had to advance, however, on account of the very much higher cost of raw materials. Everything, including labor, that goes into the manufacture of a heating device costs more.

Deliveries are longer for two reasons: First, the difficulty in getting raw materials, and, second, the congestion of the factories. The difficulty in getting raw material is heightened by the freight situation.

One thing that has been very serious is the difficulty of the manufacturer in obtaining resistance wire. A prominent manufacturer of nickel-chromium wire stated that in the last few months he had seen in his office more purchasing agents than had ever before been there. It shows how much the material is needed when purchasing agents will go personally to the factory so as to be able to bring some of the wire back with them. Any amount is accepted.

Collections and credits are good. Bills are paid promptly and there appears to be more money in circulation.

Manufacturing and Industrial

Foreign Buyer for Fixtures.—Carlos C. Ludowieg, Jr., of Lima, Peru, who is stopping at the Imperial Hotel in New York City, is in the market for electric lighting fixtures.

The Elliott-Lewis Electrical Company, Phialedelphia, Pa., has moved into larger quarters at 138 North Tenth Street. The company occupied about 28,000 sq. ft. in the old building; in the present five-story and basement building, it is occupying about 35,000 sq. ft. of floor space.

The Ohio Brass Company, Mansfield, Ohio, beginning July 1, will act as general sales agent in the United States for the entire line of Course-Hinds "Imperial" headlamps for railway and mine use. The "Imperial" line includes luminous-arc, carbon-arc and incandescent headlamps.

The Roller-Smith Company, 233 Broadway, New York, has recently established an agency in St. Louis which will be in charge of G. W. Pieksen, whose headquarters will be in the Railway Exchange Building. Mr. Pieksen will handle Roller-Smith products in St. Louis and in parts of Missouri and Illinois.

The Electrose Manufacturing Company, Brooklyn, N. Y., has notified all its departments that employees called for service in connection with the troop mobilization for service in Mexico will be granted leave of absence with full pay, and that their positions will be held open for them until they return. The money which the men will receive from the Electrose Company will be in addition to their pay from the government.

The Muncie (Ind.) Oil Engine Company has recently arranged with the Challenge Company, with headquarters at Batavia, Ill., and branch offices at 1404 West Twelfth Street, Kansas City, Mo.; 916 Farnum Street, Omaha, Neb.; 2105 Pacific Avenue, Dallas Tex., for the sale of Muncie oil engines, particularly in connection with municipal lighting and pumping project jobs. The Challenge Company will also look after the interests of the Muncie Oil Engine Company in industrial and commercial fields.

Tungsten Lamp Patent Situation.—It is understood that no definite decision has been reached by the General Electric Company in regard to its future course of action in connection with the tungsten lamp patent situation. It is expected, however, that something definite will be decided on in the course of a week or ten days. The General Electric Company as owners of the Just and Hannaman patent No. 1,108,502, instituted suit for infringement against the Laco-Philips Company, which imports its lamps from Holland, and won both in the District Court of the Southern Division of New York and on appeal to the United States Court of Appeals.

Brisk Business in Transformers.—W. F. Parker, sales manager for the Packard Electric Company, Warren, Ohio, manufacturer of transformers, insulating material, automobile cables, etc., reports that his company has been doing capacity business for some time, and has been noting a particularly strong demand for its products from the Central and the Southwestern States, where many large electric developments are under way. In connection with the manufacture of transformers, the Packard Electric Company makes all of its materials, it is stated, with the exception of thread, cloth and wire, which are manufactured by outside concerns according to Packard specifications and are subject to analysis in the company's laboratories. Recently the company received a hurry call from a concern in Northern Michigan for a large-sized special-type transformer. The order was received on Monday, and on the Friday following the receipt of the order, the transformer was installed and in operation in the Michigan plant. There was no unusual disturbance of the factory schedule, it is claimed, by the company in filling this order.

Movies to Move Audience to Wash Electrically.—A motion picture devoted to the electric washing machine and iron has made its appearance under the attractive title "The Education of Mrs. Drudge." This film devotes its 1000 ft. to show how a woman shackled to the old fashioned wash tub is emancipated and made happy by the purchase of an electric washing machine and iron. It is advertising, of course, but advertising that is subordinated to human interest; and it thereby gets across its double message. The picture has been produced by the Western Electric Company, 463 West Street, New York, and is furnished to central stations and electrical dealers to further their sales of the commodities shown. The reels are in big demand, the company points out, and are well received wherever shown.

The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, has been awarded a silver medal by the Third National Exposition of Safety and Sanitation, New York City, May, 1916, in recognition of work done in the promotion of safety through its campaign for clean lamps and the development of its safety cut-out hanger, or automatic disconnecting lowering device, which is being used extensively by industrial plants and railroads. The device is designed especially for use with large nitrogen-filled lamps, the object being to keep the lamp-cleaners on the ground, in a position of safety.

Oakland's Million Dollar Auditorium Equipped with Cutler-Hammer Theater Dimmers.—The interior of Oakland's new Municipal Auditorium is divided into an arena and a theater, a stage separating them. The arena seats about 10,000 and the theater 2000. In making provision for lighting the stage, the consulting engineer, Romaine W. Myers of Oakland, had five borders installed, each border being equipped with red lamps, white lamps and blue lamps. There are more than 1500 40-watt lamps in the borders, the large number of lamps being necessary because the balcony of the arena is 250 ft. from the stage. The border lamps, together with those in the strips and pockets, are controlled by Cutler-Hammer dimmers, which are installed in two banks, one for the arena and the other for the theater. The dimmer plates are operated by means of handwheels within easy reach of the stage electrician. Electric service is furnished by the Pacific Gas & Electric Company.

Award of the Elliott Cresson Medal.—The Franklin Institute has awarded the Elliott Cresson gold medal for 1916 to Dr. Robert Gans of Pankow, Germany, for the discovery of a water-softening compound called "Permutit." The medal and diploma—under the deed of trust of Feb. 18, 1848, from Elliott Cresson to the city of Philadelphia—is awarded annually by the Franklin Institute on the recommendation of its committee on science and the arts, for discovery or original research. Permutit is a substance resulting from the fusing together of alumina, silica and an alkali carbonate. It has the property of interchanging one of its constituents for other elements carried in solution in water passing through it. This interchange is said to be continuous. After the compound has become exhausted under a complete interchange of elements, it may be regenerated, it is pointed out, by passing through it another solution which restores the original element. The compound is being placed on the market by the Permutit Company, 30 East Forty-second Street, New York. This company reports that more than 500 industrial plants in the United States, besides hundreds of others in Germany, France and England, are using the material.

NEW YORK METAL MARKET PRICES

	June 20 Selling Prices Bid	Asked	June 27 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot	106 0 0		102 0 0	
Prime Lake	26.75 to 27.25†		26.62½ to 26.87½†	
Electrolytic	26.75 to 27.25†		26.62½ to 26.87½†	
Casting	24.50 to 24.75†		24.00 to 24.25†	
Copper wire	30.00 to 31.00†		29.00 to 31.00†	
Lead	7.00		7.00	
Nickel	45.00 to 50.00		45.00 to 50.00	
Sheet zinc, f.o.b. smelter	20.00†		19.00†	
Spelter	12.30 to 12.55		11.67½ to 11.92½	
Tin, straits	40.75		39.00	
Aluminum, 98 to 99 per cent	61.00 to 63.00†		60.00 to 62.00†	

OLD METALS

Heavy copper and wire	20.00 to 20.50†	17.00 to 18.00†
Brass, heavy	12.50 to 12.75†	11.00 to 11.25†
Brass, light	9.50 to 10.00	9.00 to 9.50†
Lead, heavy	5.37½ to 5.62½†	5.25 to 5.50†
Zinc, new scrap	8.00 to 8.50†	9.00 to 9.50†

*COPPER EXPORTS

Total tons to June 27 29,256

†Nominal.

Corporate and Financial

Cumberland County Power & Light Company, Portland, Me.—The Maine Public Utilities Commission has authorized the company to sell at 94 and accrued interest $350,000 of its first and refunding mortgage 5 per cent gold bonds due on Dec. 1, 1942. The proceeds are to be used (1) to reimburse the treasury of said company for expenditures made prior to May 1, 1916, for extensions, additions and betterments to the amount of $35,583.82 not already reimbursed, (2) for the purchase of the capital stock of the Westbrook Electric Company and (3) in extensions, additions and permanent betterments now being made by the company.

Great Western Power Company of California, San Francisco, Cal.—A consolidated statement of earnings of the corporation and subsidiary companies for the year ended Dec. 31, 1915, inter-company items eliminated, follows:

Operating revenues:		
Electric	$2,989,678	
Steam	52,097	
Other decrease	3,571	
Total		$3,038,204
Operating expenses and taxes:		
Operating expenses:		
Production	$289,639	
Transmission and distribution	189,592	
Commercial	156,831	
Steam service	42,911	
General and miscellaneous	113,252	
Total operating expenses	$792,225	
Taxes	169,767	
Total operating expenses and taxes		961,992
Net earnings		$2,076,212
Other income:		
Interest charged to capital:		
On current construction	$5,349	
On excess investment over requirements for present operations	204,343	
Interest on notes and accounts receivable	21,982	
Rentals and leases	16,953	
Total		248,627
Gross income		$2,324,839
Income charges:		
Uncollectable electric bills	$11,927	
Rentals and leases	30,558	
Non-operating expenses	17,823	
Non-operating taxes	4,783	
Interest on notes and accounts payable	25,305	
Amortization of bond discount and expenses	55,700	
Total		146,096
Net income before charging interest on funded debt		$2,178,743
Interest on funded debt		1,311,742
New income for the year		$867,001
Profit and loss surplus at beginning of year		$1,905,567
Profit and loss credits:		
Discount on bonds purchased for sinking funds	$9,283	
Release, through operation of sinking fund of bonds pledged with trustee of California Electric Generating Company and considered outstanding	14,000	
Net earnings of properties purchased by Consolidated Electric Company between date of sale and date of possession	13,619	
Refund State of California corporation license taxes	2,100	
Unclaimed wages and bad debts recovered	1,307	
Total		40,309
Profit and loss, gross surplus		$2,812,877
Profit and loss charges:		
Guaranteed dividends on preferred stock of California Electric Generating Company	110,400	
Sinking fund appropriations	172,546	
Realized depreciation not covered by reserve	29,499	
Reserve for income vested in fixed capital since Dec. 31, 1912	20,880	
Expenses in connection with sale of Great Western Power Company of California debentures	8,000	
Expenses applicable to prior years	1,724	
Sundry accounts charged off	1,250	
Total		344,299
Profit and loss surplus at end of year		$2,468,578

After reviewing the financial operation which the company has gone through during the past year, M. Fleishhacker made the following statements in regard to progressive activities and prospective developments:

"Through the efforts of our company a good start is being made in developing the electrochemical industry in California. The Great Western Electrochemical Company was organized by Californian and Eastern interests, and at this time an extensive plant is being constructed at the upper end of San Francisco Bay, and under our transmission line. The initial installation of this plant will require 2500 hp., and a long-term contract for this amount of power has been entered into by our company. The electrochemical company will, during this coming summer, commence the manufacture of caustic soda and bleaching powder. Among the large construction projects now under contemplation is the erection of a second tower line from the Feather River plant to Oakland, which will give sufficient capacity to supply the growing needs for electric energy in San Francisco, Oakland and the entire Bay region. We also have plans well under way for the erection of a second power house on the Feather River. The plans as developed have been so worked out that the new power house may be enlarged from time to time in units of approximately 20,000 kw., as the requirements of the company call for additional capacity. Recent financing has placed at our disposal sufficient funds for all of the new work contemplated for the year 1916 and well into 1917. With our finances in splendid condition, our generating plants and our distributing system well maintained and operating efficiently, and with a large amount of undeveloped power at our disposal for which we have a constantly expanding demand at profitable rates, it is quite reasonable to look forward to a material growth in the business and substantially better results for the year 1916."

Hartford (Conn.) Electric Light Company.—The board of directors of the company has voted to recommend to the stockholders that the capital stock be increased from $3,600,000 to $4,000,000. The 9000 shares thus created will be offered at par value, $100, to the stockholders of record at the time of the offer.

North Shore Electric Light & Power Company, Port Jefferson, N. Y.—The Public Service Commission for the Second District of New York has authorized the Port Jefferson Electric Light Company to transfer all of its rights and property, except one parcel of vacant land in the village of Port Jefferson, to the North Shore Electric Light & Power Company, subject to mortgage bonds of $28,000. To acquire these assets the North Shore company is authorized to issue $20,000 of its capital stock at par and $53,000 of its 5 per cent first mortage bonds at not less than 85, both issues to net a sum of $65,000, of which $37,000 will be paid to the Port Jefferson company and $28,000 will be used to discharge the Port Jefferson bonds above mentioned.

Northern States Power Company, Chicago, Ill. — The Northern States Power Company of Delaware, which owns all the preferred and common shares of the Northern States Power Company of Minnesota—the operating company—has increased its authorized capitalization from $14,000,000 preferred and $16,000,000 common to $50,000,000 preferred and $50,000,000 common by action of the stockholders. Additional stock will be issued from time to time to provide for further development of the company.

Sierra Electric Power Company, Oakland, Cal.—The application of the company to issue bonds and to furnish electricity to the rice districts of Glenn, Colusa and Yolo counties, California, was heard by the California Railroad Commission on June 14. The original company was organized in 1911 by a number of Oakland financiers and capitalized at $3,000,000. About $15,000 was spent on the project then, it is reported, but since that time it has been dormant. The present organization took over the assets of the original corporation in return for $3,000,000 in stock and $25,000 in cash, it was affirmed at the hearing, and the new company now plans to construct two power plants on Digger Creek in Tehama County, with a capacity of 3500 kw., and to build 105 miles of transmission line to serve the rice belt. In order to do this it asks the commission for authority to issue $3,000,000 of 6 per cent bonds at 82.5. Portions of the district are already served by the Pacific Gas & Electric Company and the Northern California Power Company, who oppose the application.

Toronto (Canada) Electric Light Company, Ltd.—A new issue of $1,000,000 of first mortgage three-year 5 per cent gold bonds due on July 1, 1919, is being offered at 99.5 and interest.

New Utility and Industrial Companies

The Cleveland (Ohio) Power Transmission Company has been incorporated with a capital stock of $40,000 by R. V. Selby, Elmer E. Lenarz, E. H. Krueger, Herman J. Nord and A. L. Winsper.

The Platea (Pa.) Borough Light & Power Company has been incorporated with a capital stock of $5,000 by C. H. Allen, A. A. Culbertson and C. M. Hatch of Erie. The office of the company is located in Erie.

The Fairview (Pa.) Borough Light & Power Company has been chartered with a capital stock of $5,000 by C. H. Allen, A. A. Culbertson and C. M. Hatch of Erie. The office of the company is located at Erie.

The Petersburg (N. D.) Electric Company has been incorporated with a capital stock of $6,000 to install and operate an electric light plant in Petersburg. The incorporators are: M. O. Loken, A. R. Swensend and J. O. Engesather.

The Lenox Electric Company of New York, N. Y., has been incorporated by J. Myers, B. Salzman and W. Cohen, 100 West 142nd Street, New York. The company is capitalized at $5,000 and proposes to do general electric contracting work.

The Cen-Ke Manufacturing Company of Clinton, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in electrical devices, appliances, etc. The incorporators are: J. P. Kelly, W. V. Keith and G. A. Centolella of Clinton, N. Y.

Lindgren & Solomon, 9 South Clinton Street, Chicago, Ill., has filed articles of incorporation with a capital stock of $5,000 for the purpose of dealing in electrical goods and supplies. The incorporators are Oscar Lindgren, Samuel Solomon and William Mannhart.

The Montana Power Construction Company of Butte, Mont., has been incorporated with a capital stock of $50,000 by M. E. Buck, Stephen P. Hogan and Henry F. Kroyer. The company proposes to construct dams, reservoirs and canals, etc.; also systems for the distribution of gas and electricity.

The Carl Anderson Electric Corporation of New York, N. Y., has been incorporated with a capital stock of $200,000 by T. F. MacMahon, B. C. Elliott and S. M. Kelleher, 1400 Broadway, New York. The company proposes to manufacture and deal in telephone devices, electric sound transmitting devices, etc.

The Hollis (N. H.) Electric Light Company has been incorporated by Thomas E. Whittaker, Alfred L. Shearer, Daniel C. Parsons of Shirley, Mass.; Harry F. Greeley of Nashua, N. H., and Thomas F. Murray of Newton, Mass. The company is capitalized at $5,000 and proposes to generate and distribute electricity.

The Kokomo (Ind.) Oscillating Fan Company has been organized by H. O. Bell of Indianapolis, Ind., and T. F. English of Muncie, Ind. The company has taken over the patents of the Storm Wave fan invented by L. Greenburg and Gustaf Olson, and is equipping a factory to manufacture oscillating fans. Ernest Seward of Kokomo is treasurer of the company.

The Universal Power Company of Grand Rapids, Mich., has filed articles of incorporation with a capital stock of $60,000 for the purpose of generating gas and developing power to generate electricity for distribution in Montcalm and Mecosta Counties, Howard City and Morley being the principal cities benefited. The directors are: James M. Donahue, George Arnold and George M. Doty.

The Victor Electric Corporation of New York, N. Y., has filed articles of incorporation with a capital stock of $2,500,000. The company has purchased the business and property of the Victor Electric Company of Chicago and New York; the Scheidel-Western X-Ray Company of Chicago and New York; the MacAlaster-Wiggin Company of Cambridge, Chicago and New York; and the Snook-Roentgen Manufacturing Company of Philadelphia and New York. The officers of the company will be: Charles F. Samms, president; Clinton W. Howe, vice-president; Fred A. Wiggin, treasurer, and Theodore B. McClintock, secretary and manager of sales.

Trade Publications

Used Machinery.—MacGovern & Company, 114 Liberty Street, New York, are sending out their May 15 list of used power machinery.

Boilers.—The Walter A. Zelnicker Supply Company, St. Louis, Mo., has issued Bulletin No. 201 which contains information on used boilers.

High-Tension Switches.—The Pacific Electric & Manufacturing Company, San Francisco, Cal., has issued Bulletins No. 200 and No. 600 on its high-tension switches.

Steel Reflectors.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued Bulletin No. 15-16 on the new focusing type, distributing type and intensive type steel reflectors.

Electric Cloth Cutter.—The Eastman Machine Company, Buffalo, N. Y., has prepared an illustrated folder which describes in detail its portable electric cloth-cutting machine.

Bond Testers.—The Roller-Smith Company, 233 Broadway, New York, has issued Bulletin No. 200 on portable direct-reading bond testers for testing the conductivity of rail bonds.

Multi-Stage Centrifugal Pumps.—Bulletin No. 120, issued by the Goulds Manufacturing Company, Seneca Falls, N. Y., describes and illustrates several types of electrically-operated multi-stage centrifugal pumps.

Galvanometer Lamp and Scale.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued illustrated Bulletin No. 219A, which describes a galvanometer lamp and scale for use with its galvanometers.

Soot Cleaners.—The Vulcan Soot Cleaner Company, Du Bois, Pa., has prepared an attractively illustrated folder which contains considerable information on the company's soot cleaners which were recently described in these columns.

Electric Hoists.—Bulletin No. 48906, published by the Sprague Electric Works of the General Electric Company, 527 West Thirty-Fourth Street, New York, is attractively illustrated and contains information on the Type S-1 0.5-ton and 1-ton electric hoists.

Oil Engines.—The De La Vergne Machine Company, East 138th Street, New York, has issued Bulletins No. 154 and No. 155 on its type "FH" crude oil engines with ratings of 150 hp., 300 hp., 450 hp., 600 hp., 900 hp. and 1200 hp., and on oil engines for irrigation work.

Window-Display Contest.—The Hotpoint Electric Heating Company, Ontario, Cal., has prepared a folder illustrated in colors which contains information on its $300 prize-window display contest which will be held in connection with "Hotpoint Week," July 3-8.

Renewed Tungsten and Carbon Lamps.—The Boston Economy Lamp Division of the National Lamp Works of the General Electric Company, 128 Maple Street, Danvers, Mass., has prepared lists on its "Eagle" renewed tungsten lamps and its "Boston" renewed carbon lamps.

Electric Pleasure Vehicles.—The Baker R & L Company, Cleveland, Ohio, is sending out attractively illustrated bulletins which describe and illustrate various types of its electric pleasure cars and also several illustrated bulletins which contain information on the Owen magnetic car.

Protective Systems for Service Connections.—The H. W. Johns-Manville Company, New York, has prepared illustrated Catalog No. 417, which describes the "Universal Noark" protective system for service connections. This system was the subject of an article that appeared in the Electrical World of June 17.

Posters for the Conservation of Industry.—The National Association of Manufacturers of the United States of America, 30 Church Street, New York, has prepared ten posters designated as Series B posters which are to be used in connection with the association's campaign for the conservation of industry. This is a national movement, according to a statement of the association, to inform all classes of citizens as to their true relation to industry and its actual bearing on their own prosperity. A folder is being sent out which shows in miniature reproductions of the posters which are 19 in. by 25 in.

New England

WESTFIELD ME.—The Westfield Electric Company, recently incorporated with a capital stock of $10,000, contemplates the construction of an electric-light and power plant. R. J. Colbath, H. A. Anderson of Mars Hill, and A. C. Frost of Limestone are interested in the company.

PORTSMOUTH, N. H.—The Public Service Commission has authorized the Rockingham County Light & Power Company of Portsmouth to issue $750,000 in bonds.

ST. ALBANS, VT.—The Public Service Commission has authorized the Public Electric Light Company of St. Albans to issue $20,000 in capital stock, the proceeds to be used for the erection of an electric transmission line from its power plant in Fairfax to a substation in Cambridge, and the construction of electric distributing systems in Cambridge and Jeffersonville. The company is also granted permission to erect a high-tension transmission line from its power plant in Fairfax to a substation to be built in Cambridge, a distance of about 7 miles.

SOUTH RYEGATE, VT.—The property of the Ryegate Light & Power Company of South Ryegate has been purchased by the Vermont Public Utilities Corporation. I. M. Frost of Rutland is president of the Vermont company.

LOWELL, MASS.—The Lowell Electric Light Corporation is building an electric transmission line to North Chelmsford, a distance of about 5 miles, 2.5 miles being underground conduit.

MILFORD, MASS.—Plans are being prepared, it is reported, for a new power house at the Milford plant of the Regal Shoe Company.

NEWBURYPORT, MASS.—The Board of Gas and Electric Light Commissioners has granted the Newburyport Gas & Electric Company permission to issue 570 shares of new capital stock at $130, the proceeds to be used to pay for extension of lines into West Newburyport and construction begun on its new power station in Newburyport.

QUINCY, MASS.—The installation of a municipal electric-lighting plant in Quincy is under consideration.

SALEM, MASS.—The new contract between the city of Salem and the Salem Electric Lighting Company, by which the latter is to install a new street-lighting system, has been signed. The new contract is for a period of ten years and provides for many new lamps to be installed in the business section of the city and other principal streets.

WATERBURY, CONN.—Plans are being prepared by the United Electric Light & Water Company of Waterbury, it is reported, for the construction of a large power plant on the Housatonic River, just east of Bridgeport, to supply electricity to cities and towns in the Naugatuck Valley. At present the company purchases energy from the Husatonic Power Company.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 11 for furnishing single-conductor cable, radio transmitting sets, etc., at the Brooklyn navy yard. Proposal blanks may be obtained at the navy yard, Brooklyn, or at the above bureau.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Deprtment of Education, Park Avenue and Fifty-ninth Street, New York, until July 10 for installing electric-lighting equipment in Public School 120, teachers' and janitors' houses on Barren Island, borough of Brooklyn. Blank forms and specifications, etc., may be obtained at the above office.

COOPERSTOWN, N. Y.—The Public Service Commission has authorized extensions of the electric transmission lines of the Colliers Light, Heat & Power Company of Cooperstown into Otsego County. The taking over of the franchise of the Hartwick (N. Y.) Seminary Lighting Company is approved by the commission and the Colliers company is authorized to maintain this and such extensions to plant as may be necessary. The franchises granted the company in the towns of Milford, Otsego, Exeter and Laurens have also been approved by the commission.

LACONA, N. Y.—At a special election held recently the proposal to install an electric-lighting system in Laconia was carried.

LANCASTER, N. Y.—The Depew & Lancaster Light, Power & Conduit Company of Lancaster has applied to the Public Service Commission for authority to issue $72,000 in bonds and also for permission to acquire bonds and stock of the Inter Village Electric Corporation.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, Army Building, New York, N. Y., until July 3 for furnishing 400 automobiles.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, Army Building, New York, N. Y., until July 8 for furnishing from one to fifty machine shop trucks, with complete equipment, including gasoline electric generating sets and hand tools.

NEW YORK, N. Y.—The Public Service Commission of First District, 120 Broadway, has submitted to the Board of Estimate and Apportionment a requisition for an appropriation of $25,000 for construction of a duct line on Queens Boulevard Viaduct in Queens Borough, along the line of the new Corona Rapid Transit Railroad.

PERRY, N. Y.—The installation of an ornamental lighting system on Main Street from Gardeau Street to Mill Street is under consideration. The Perry Electric Company has offered to pay one-half of the cost of installing the system.

SANDY CREEK, N. Y.—At a special election held recently the proposal to install an electric-lighting system in Sandy Creek was carried. The trustees were authorized to expend a sum not exceeding $700 annually for lighting the streets and public grounds by electricity.

WOLCOTT, N. Y.—The Northern Wayne Electric Light & Power Company has submitted a proposal to the Council offering to install a new street-lighting system in Wolcott, which will include a number of ornamental standards.

BEAVER FALLS, PA.—The Petersville Electric Company, recently incorporated with a capital stock of $5,000 to operate in Conoquenessing Borough, will have its offices in Beaver Falls. W. S. Craig, J. D. Perrott and others of Pittsburgh are interested in the company.

COOPERSBURG, PA.—The Town Council is considering the purchase of the local electric-lighting system.

FRANKLIN, PA.—Application has been made to the State Department at Harrisburg for charters for the Franklin Township Electric Company and the Cleveland Township Electric Company. It is proposed to build an electric plant to supply electrical service to the residents of the two townships. Samuel D. Warriner, Rollin H. Wilbur and H. F. Baker are interested in the project. William J. Turner is solicitor.

HAZLETON, PA.—The Harwood Electric Company has been granted permission by the Public Service Commission to install an ornamental lighting system in Hazleton.

PHILADELPHIA, PA.—The John T. Bailey Company is contemplating the construction of a new boiler plant at its rope factory on Front Street, Philadelphia.

PHILADELPHIA, PA. — The Mifflin Chemical Works is planning the construction of a new power plant at its factory on Delaware Avenue. Contract for the building has been awarded.

PHILADELPHIA, PA.—Negotiations are under way between the City Council and the Hunting Park Improvement Association for the installation of electric lamps in the York Road Bridge district.

PHILADELPHIA, PA.—Plans are being prepared by John T. Windrim for a seven-story office building for the Philadelphia Electric Company, to be erected at 1004 Chestnut, adjoining its main office building.

POTTSTOWN, PA.—William M. Rutter, it is reported, is planning to install an electric-light plant at the former grist mill site.

BRIDGETON, N. J.—Preparations are being made by the Seabrook Farms Company to secure electricity from the Bridgeton Electric Company. It is proposed to equip the entire property for electrical service, including administration building, tenement houses, greenhouses and other buildings.

GLEN GARDNER, N. J.—A committee, headed by Charles Banghart, has been organized to make arrangements for the installation of a street-lighting system.

NEWARK, N. J.—Bids will be received by the committee on public buildings of the Common Council for a new electric elevator for the northwest wing of the City Hospital on Camden Street. Frederick A. Phelps, 9 Clinton Street, Newark, is architect; Thomas J. Lee, Jr., is chairman of committee.

TRENTON, N. J.—The contract for the erection of a new power plant for the New Jersey State Hospital has been awarded to De Kompe Brothers of Hoboken, at $25,800.

TRENTON, N. J.—The Public Service Electric Company has presented plans to the City Council for the installation of a new street-lighting system on Broad, State and Warren Streets.

BALTIMORE, MD.—Plans are being prepared by the United Railways & Electric Company for construction of a substation on Belvidere Avenue. The equipment will include two or three 1500-kw. rotary converters with necessary transformers, switchboards and auxiliary apparatus.

FAIRMOUNT, W. VA.—The Monongahela Valley Traction Company of Fairmont is contemplating the installation of an additional generating unit in its Hutchinson plant.

SPENCER, W. VA.—The local electric-light plant has been purchased by the Wieland Electric Company, which will make improvements and extension to the property. The company will be in the market for line construction materials, including wiring supplies, etc. R. G. Wieland is owner and general manager.

CLIFTON FORGE, VA.—Arrangements are being made by the Virginia-Western Power Company of Clifton Forge to extend its transmission line from Alderson, the present western terminal, to Hinton, W. Va., a distance of 21 miles. Part of the right of way has been secured. W. G. Mathews is president.

FRONT ROYAL, VA.—Bonds to the amount of $19,000 have been voted for improvements to the hydroelectric plant, 1¾ miles from the city. The work will include new water wheels, penstock, shafting, etc. E. V. Dunstan, Southern Building, Washington, D. C., is engineer.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, Washington, D. C., until July 3 for furnishing buzzer wire in lots of 250 miles to 1000 miles. For further information address Charles S. Wallace, captain signal corps, U. S. Army.

WASHINGTON, D. C.—Bids will be received by the United States Marine Corps, Quartermaster's Department, Washington, D. C., until July 10 for furnishing to the Marine Corps one motor truck of 3000 lb. capacity. For further information address C. L. McCawley, colonel quartermaster.

North Central

GRAND RAPIDS, MICH.—The Sixth Ward Improvement Association has raised $7,500 of the $10,000 required for the ornamental lighting system on Leonard Street, N. W. Work will begin on the installation of the system as soon as the balance of the money is raised.

HANCOCK, MICH.—The City Council has decided to engage an electrical engineer to prepare plans for the construction of a municipal electric-light plant. Preliminary estimates place the cost at $40,000.

ST JOHNS, MICH.—The Board of Public works is receiving bids for one alternating-current electric generating unit, directly connected, for the municipal electric-light plant.

BLOOMFIELD, OHIO.—Plans are being considered for the installation of an electric-lighting system in Bloomfield. Post office address is Centerburg, Ohio.

ST. BARNARD, OHIO.—Contracts, it is reported, are being let by Tietig & Lee, Archts., Fourth National Bank Building, Cincinnati, for a large power plant for Ault & Wiborg Company's coloring works at St. Barnard, from revised plans.

CROTHERSVILLE, IND. — The City Council has granted a franchise to Frank Brady, attorney, to install and operate an electric-light plant, and has also entered into a contract for street-lighting.

GREENSBURG, IND.—Plans are being considered by the Business Men's Association for the installation of an ornamental lighting system in the business section.

GIBSON CITY, ILL.—The City Council has authorized plans prepared for an electric-light plant and water-works system.

JOLIET, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 12 for a new boiler in the post

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

office at Joliet, Ill. For details see proposal columns.

KINGSTON, WIS.—The Ripon (Wis.) Light & Water Company has secured an option on the local electric-light plant. It is proposed to connect the two plants and also to supply electricity in the towns of Markesan and Dalton.

MONTICELLO, WIS.—Bids will be received by the Village Trustees addressed to Henry M. Marty, village clerk, Monticello, until July 12 for the following equipment: One 100-hp. oil engine, suitable for direct connection, one 75-kva., three-phase, 60-cycle, 2300-volt generator with exciter, one generator panel with necessary instruments and equipment, one 20-hp., three-phase, 2300-volt induction motor and electrical supplies. Specifications and further information may be obtained from Harrison A. Smith, electrical engineer, Vroman Block, Madison.

NEW RICHMOND, WIS.—Bids will be received by A. Deneen, clerk of the Board of Education, New Richmond, Wis., until July 6 for construction of new public grade school building, plumbing, electric wiring and heating plants for both new and old buildings. Plans and specifications may be seen at the office of the clerk, New Richmond, Builders' Exchanges in St. Paul, Minn., and Milwaukee, Wis., and at the office of Volkman & Hancock, architects, Eau Claire, Wis.

UNION GROVE, WIS.—Bids will be received by the State Board of Control, Capitol Building, Madison, Wis., until July 20 for construction complete, except plumbing, heating and lighting, of two 60-patient buildings, one superintendent residence, one 48-patient building, cow barn building, incubator, etc., at the Southern Home for Feeble-Minded and Epileptic at Union Grove, in accordance with plans and specifications prepared by Robert Messmer & Brother, architects, Milwaukee. Plans and specifications will be on file in the office of W. Carbys Zimmerman, architect, 64 East Van Buren Street, Chicago, Ill., after July 5.

AUSTIN, MINN.—Bids will be received by the City Water, Electric, Gas and Power Commissoners of the city of Austin until July 11 for putting on a new roof and raising walls of present power station and installing a ventilating system. Plans and specifications may be seen at the office of the commissioners and at the office of F. W. Kenney, architect, Plymouth Building, Minneapolis, Minn.

MINNEAPOLIS, MINN.—Bids will be received by the Board of Education of Minneapolis until July 6 for general work for rebuilding, alteration and addition to the Franklin High School. General plans and specifications may be seen at the office of R. V. L. Haxby, architect, for Board of Education, City Hall, Minneapolis. Bids will also be received until July 12 for mechanical equipment for Franklin High School, plans and specifications for which may be seen at the office of Rose & Harris, 470 Auditorium Building, Minneapolis.

RED WING, MINN.—Bids will be received by C. E. Sheldon, president, Red Wing, Minn., until July 12 for construction of one high school and one grade school building, boiler house, etc., in the city of Red Wing. Separate bids to be submitted at the same time for heating, plumbing and electric work. Plans and specifications are on file in the office of the superintendent of schools at Red Wing, and at the office of Bell & Bentley, architects, Security Building, Minneapolis.

BANCROFT, IOWA.—An election will soon be held to submit to the voters the proposal to issue bonds for an electric-lighting system.

FORT DODGE, IOWA.—Contracts have been awarded for construction of the hydroelectric plant as follows: For dam, power house, etc., to the Koss Construction Company of Des Moines, at $80,000 and for machinery to the Merkle-Hines Machinery Company, Interstate Building, Kansas City, Mo. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

McGREGOR, IOWA.—Arrangements are being made by the McGregor Electric Light & Power Company for the erection of an electric transmission line through Monona to Luana and thence to Postville, where the plant of the Upper Iowa Power Company is located. As soon as the line is completed the McGregor company will use energy generated at the plant of the Upper Iowa Company for service in McGregor, Monona, Luana and intermediate points instead of from the steam plant in McGregor.

MARSHALLTOWN, IOWA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 12 for furnishing a new boiler, etc., for the post office at Marshalltown. For details see proposal columns.

OSAGE, IOWA.—Bids will be received by the board of education of Osage addressed to Miss A. E. Knoulton, secretary of the independent school district of Osage, until July 17 for construction of school building, separate bids to be submitted as follows: General contract, plumbing and ventilating, electric wiring and plumbing. Plans and specifications are on file at the office of J. F. Leitha, architect, Waverly, Iowa.

TABOR, IOWA.—The contract for the installation of an electric-lighting system has been awarded to the McGraw Company of Omaha, Neb., at $4,920.

HANNIBAL, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 17 for new heating system, plumbing, etc., in the United States post office at Hannibal, Mo. For details see proposal columns.

KANSAS CITY, MO.—Bids will be received by the board of directors of the school district of Kansas City, Mo., at the office of the secretary of board, Public Library Building, until July 6 for furnishing and installing heating and ventilation and plumbing; temperature regulation, electric wiring and electric generating sets in the public library building and addition thereto, located on the corner of Ninth and Locust Streets, Kansas City. Plans and specifications may be seen at the office of J. H. Brady, chief engineer, Finance Building, Kansas City, Mo.

DUNN CENTER, N. D.—The installation of an electric-light plant and water-works system in Dunn Center is under consideration.

BENNET, NEB.—Arrangements have been made for the installation of an electric-light plant in Bennet. Fred Steiber is interested in the project.

LINCOLN, NEB.—Bids will be received at the office of J. S. Dales, secretary of the University of Nebraska, Station A, Lincoln, Neb., until July 22 for construction of an Agricultural Engineering Building on the University Farm Campus near Lincoln. Separate bids will be received for installation of heating and ventilating, plumbing and electric wiring for building. The cost of the buildings is estimated at $140,000.

SHUBERT, NEB.—The installation of a municipal electric-light plant is under consideration. Electricity for operating the plant may be purchased.

WAHOO, NEB.—Bids will be received until July 26 by the city of Wahoo for the purchase of the following machinery: One 225-hp. either simple or compound Corliss engine, or one 225-hp. uniflow engine, same to be directly connected to a 150-kva, 2300-volt generator, exciter, switchboards, a 25-hp. motor and a triplex pump. H. M. Robertson is superintendent.

KANSAS CITY, KAN.—The franchise of the KansasCity Terminal Railway Company, to be submitted to the voters on July 6, provides that the company shall install wires and equipment for lighting the street crossings, the city to furnish electricity to maintain the lamps.

LEAVENWORTH, KAN. — The City Commissioners have decided to replace the gas lamps now in use with tungsten electric lamps. The street-lighting service is supplied by the Leavenworth Light, Heat & Power Company.

MINNEOLA, KAN.—At an election held recently the proposal to issue bonds for the erection of a transmission line from Dodge City to Minneola and a new distribution in Minneola was carried. The city will purchase electricity from the Midland Light & Power Company of Dodge City to operate the proposed municipal electric-lighting system.

WICHITA, KAN.—Plans have been approved by the board of education for the electric wiring of 28 school buildings. The board has been authorized to advertise for bids for the work.

Southern States

DUNN, N. C.—Improvements are contemplated to the municipal electric-light plant and water-works system, involving an expenditure of about $10,000. Gilbert C. White of Durham, N. C., is consulting engineer.

MOREHEAD CITY, N. C.—Bids will be received by the town of Morehead City at the office of the town clerk, until July 10 for material and machinery for improvements to the electric-light plant as follows: one 150-hp. boiler, stack and steel casing, one 300-hp. heater, one 180 to 210-kva. generator directly connected to uniflow engine, one 90-kva. generator (belted), one 25-kva. street-lighting regulator, switchboard, one jet condenser, one motor-driven centrifugal or triplex pump (250 gal. per minute capacity), thirty 30-ft. poles, forty 25-ft. poles, 52,200 ft. No. 8 T. B., W.P. copper wire, 14,400 ft. No. 6 T. B., W.P. copper wire, 600 ft. No. 4 T. B., W. P. copper wire, pole line material, list on request. Specifications may be obtained on application to the J. B. McCrary Company, engineers, Atlanta, Ga.

PILOT MOUNTAIN, N. C.—The installation of an electric-light plant in Pilot Mountain is under consideration. Job Hiatt of Pilot Mountain, and Dan Chatham of Winston-Salem, N. C., are interested in the project.

SALISBURY, N. C.—Bids will be received by the Board of Water Commissioners of Salisbury until July 12 for construction of a new filtration plant and a source of new water supply, including furnishing and installing motor-driven centrifugal pumps, filtration plant, filter house, power station, gate valves, tower and tank, transformers and other appurtenances; also laying 5½ miles of either 14 or 16-in. cast-iron pipe line. Plans and specifications are on file at the above office and at the office of J. L. Ludlow, Winston-Salem, N. C., engineer. Mayor Walter H. Soodson is chairman of commission.

UNIVERSITY, N. C.—The trustees of the University of North Carolina have authorized an expenditure of $42,000 for the installation of an electric-lighting system, water-works and heating plant. It is also proposed to furnish electricity for lamps and motors to the town of Chapel Hill. The J. B. McCrary Company of Atlanta, Ga., has charge of the engineering work.

CLINTON, S. C.—The Carolina Rapid Transit Company, recently incorporated, contemplates the construction of an electric railway connecting Spartanburg, Union, Woodruff, Enoree, Laurens and Clinton, about 85 miles. J. F. Jacobs of Clinton, and others, are interested.

HAHIRA, GA.—Bonds to the amount of $8,500 have been voted for improvements to the municipal electric-lighting system.

SAVANNAH, GA.—Extensions to the electric-lighting system are under consideration. E. R. Conant is city engineer.

PLANT CITY, FLA.—A report submitted to the City Council by the H. S. Jaudon Engineering Company, Savannah Bank & Trust Building, Savannah, Ga., estimates the cost of construction of a combined electric-light and pumping plant at $91,000. Nordberg engines of from 350 to 400 hp. each; two 150-hp. boilers, two generators of 150 kva. each, new pumping station, etc.

BIRMINGHAM, ALA. — Surveys have been completed by the Birmingham Interurban Development Company for the construction of an electric railway from Warrior River at Nicholas Fishtrap to Jasper via Dora, Cordova and Flat Creek, a distance of about 28 miles. The company proposes to build a railway from Birmingham to Jasper, about 50 miles. W. W. Shortridge of Birmingham is secretary.

BIRMINGHAM, ALA.—The Alabama Power Company of Birmingham has awarded contract for construction of foundations for the steam driven-electric generating station on Mulberry Creek of Warrior River, 7 miles from Cordova, to the Jefferson Construction Company. The building is to be 163 ft. by 88 ft. and 60 ft. high, brick and concrete construction; contract for steel has been let to the Ingalls Iron Company of Birmingham. The company has not yet decided whether to award general construction contract or to undertake the work with its own force. The plans provide for developing 35,000 hp. as auxiliary to the hydroelectric plant on Warrior River at Lock 12. The cost of the steam plant is estimated at $1,500,000.

DECATUR, ALA.—Bonds to the amount of $50,000 have been voted for the installation of a municipal electric-light plant. Xavier A. Kramer of Magnolia, Miss., is consulting engineer.

SPRING HILL, ALA.—The Mobile Country Club has awarded contract for construction of club house, to cost $28,000, to E. J. Raub & Company of Mobile. The lighting plant will cost $2,000. George B. Rogers of Mobile is architect.

BALDWYN, MISS.—Bids will be received by the town of Baldwyn until July 12 for furnishing machinery, materials and equipment for construction of water-works, pumping station and electric-lighting plant, including the erection of a pumping and power station, reservoir, oil engines, generators and switchboard, electric line and street-lighting system. Specifications, plans, etc., may be seen at the office of the Mayor at Baldwyn, or may be obtained on application to Xavier A. Kramer, consulting engineer, Magnolia.

GOODMAN, MISS.—Bids will be received by the town of Goodman until July 6 for furnishing machinery, materials

and constructing complete an electric-lighting system, including an oil engine, generator, switchboard, transformers, electrical material and street-lighting system. Proposals are also invited on a direct-current installation, consisting of an engine, generator, switchboard, storage battery, electric line and street-lighting system. Specifications, plans, etc., may be seen at the office of the Mayor in Goodman, or may be obtained on application to Xavier A. Kramer, consulting engineer, Magnolia, Miss.

TYLERTOWN, MISS.—Bids will be received by J. C. Luter, clerk board of supervisors of Walthall County, Tylertown, until July 20 for construction of brick court house building, jail and equipment. Separate bids will be received at the same time for heating, plumbing, electric wiring and fixtures, jail cells and court house furnishings. Plans, specifications and blank forms can be obtained on application to Xavier A. Kramer, architect and engineer, Magnolia, upon deposit of $25.

LEACHVILLE, ARK.—A franchise has been granted to E. Johnson and J. T. Alford of Blytheville to install and operate an electric-light plant and ice factory in Leachville. The proposed plant will cost about $5,000.

STUTTGART, ARK.—The City Council has granted F. G. Prout, representing Eastern capitalists, a 50-year franchise to install and operate an electric-light plant and water-works system.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 2 for the installation complete of an electric freight elevator and remodeling two electric passenger elevators in the United States custom house, New Orleans, La. For details see proposal columns.

BLANCHARD, OKLA.—The installation of a municipal electric-light plant and water-works system in Blanchard is under consideration.

BROMIDE, OKLA.—Plans are being considered for the installation of a municipal electric-light plant and water-works system in Bromide.

GALVESTON, TEX.—Bids will be received at the office of the supervising architect, Treasury Dept., Washington, D. C., until July 19 for an electric light plant at the United States quarantine station at Galveston. For details see proposal columns.

HICO, TEX.—Preparations are being made by the Central Texas Power & Transmission Company for extensive improvements to its plant in Hico.

SAN ANTONIO, TEX.—Work will soon begin by the San Antonio & Austin Interurban Railway Company for the construction of an electric railway from San Antonio to Austin, a distance of 78 miles. W. B. Tuttle of San Antonio is chief engineer.

Pacific States

CONCRETE, WASH.—Plans are being considered by the Superior Portland Cement Company for permanent improvements to its water power system located about 10 miles north of Concrete, which will give additional power and enable the company to generate electricity to operate its concrete plant and to supply electrical service to a portion of the city of Concrete. The work includes the construction of dams, flumes, diverting the waters of Sulphur Creek into Rocky Creek, and then diverting the waters of both streams into Bear Creek, from which the waters of all three will be carried to the power house. The wooden dams will be replaced with cement dams.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company of Portland, Ore., operating in about 36 towns and cities in eastern Washington, it is reported, contemplates the construction of a steam-driven electric plant in North Yakima and eventually acquiring the property of the Yakima Central Steam Heating Company of Yakima.

OROVILLE, WASH.—The property of the Similkameen Power Company of Oroville, it is reported, has been purchased by Walter S. Sivyer and Eugene Enloe. It is reported that $51,000 was paid for the property and that the new owners will expend about $250,000 for enlarging the plant and extending transmission lines. The work will include the construction of a dam 45 ft. high, providing a head of 85 ft., and developing 4000 hp. and the erection of 40 miles of additional transmission lines. The Similkameen plant will be taken over by the Okanogan Valley Power Company, 521 First Avenue, Spokane, Wash. Surveys will soon be made for the dam and construction will begin early next year. Eugene Enloe is president of the Okanogan Valley Power Company.

SEATTLE, WASH.—The County Commissioners have granted the Lake Forest Light, Water & Power Company a 25-year franchise to operate in Lake Forest Park.

SPOKANE, WASH.—The Spokane Service Company, a subsidiary of the Washington Water Power Company, recently incorporated, has entered the heating field in Spokane. The company is capitalized at $25,000 and proposes to engage in the business of heating either by electricity or steam; also to take charge of management and operation of plants when necessary.

SPRAGUE, WASH.—The Washington Water Power Company of Spokane has closed a contract with Dr. D. M. Strong of the Myrtle Hospital for the installation of a complete electric cooking, water heating and sterilizing equipment in the Myrtle Hospital, consisting of a Westinghouse automatic range, a 750-watt Curran water heater, a two-burner Hughes hot plate for sterilizing and a special 1500-watt electric steam sterilizer.

UNIONTOWN, WASH.—The Washington Water Power Company is rebuilding its local distributing system. The city is considering the installation of a new street-lighting system.

COVE, ORE.—The Eastern Oregon Light & Power Company of Baker, which supplies electricity in Cove, Union, La Grande and Elgin, is making improvements to its plant east of this city.

MARSHFIELD, ORE.—W. J. Wilsey of Portland, it is reported, represents a corporation which proposes to construct a pulp and paper mill, a hydroelectric power plant, a by-product plant, creosoting plant, woodenware plant, etc., in Marshfield. The company also contemplates building an electric railway from Roseburg to Coos Bay.

MARSHFIELD, ORE.—The Oregon Power Company has decided to erect a transmission line which will connect the system in Marshfield with Coquille and Myrtle Point. This line will traverse a distance of about 8 miles between Coquille and a lumber camp of the C. A. Smith Company, now served with electricity over wires owned by the lumber company. Arrangements have been made to use this line in conjunction with the company's extension from Coquille to connect the two at present separated systems of the Coos division of the power company. When completed Coquille and Myrtle Point will be served from the Marshfield plant, 15 miles distant, and the steam plant at Coquille will be dismantled.

BLYTHE, CAL.—Plans are being considered for the installation of an electric-light system in Blythe as soon as the town is incorporated.

HOLTVILLE, CAL.—The new power plant of the Holton Power Company near Holtville, will soon be completed. The company is planning to rebuild and remodel its electric and gas reserve plants in El Centro and make extensive improvements to its equipment and service in the valley.

SAN NOVATO, CAL.—The board of supervisors has granted the Novato Utilities Company a franchise to furnish electricity for lamps and motors in Novato and vicinity for a period of 25 years. William Kane is president.

HAILEY, IDAHO.—The Hailey Electric Company is contemplating the erection of an electric transmission line from the power plant at Hailey to the property of the Federal Milling & Smelting Company, which is planning to equip its plant for electrical operation.

PHOENIX, ARIZ.—The City Commission has called an election to be held Oct. 3 to submit to the voters the proposal to issue $600,000 in bonds, the proceeds to be used for the installation of municipal electric-light and gas plants.

TEMPE, ARIZ.—Plans are being considered by the City Council for the construction of a municipal electric-light plant in Tempe.

FORT BENTON, MONT.—Investigations are being made by M. L. Morris, representative of the Gerharz-Jacqueth Company of Helena, engineer, in the Peton and Marias Rivers regions near Fort Benton, with a view of installing an electric power plant in connection with an irrigation project.

GREAT FALLS, MONT.—Bids will be received by W. H. Harrison, city clerk, Court House, Great Falls, until July 10 for the improvements to water works system, separate bids to be submitted as follows: (1) Construction of concrete settling basins, filter basins, clear water basins, filter and chemical houses, extension to pumping station, etc.; (2) for furnishing and installing eight 1,500,000-gal. mechanical filter units; (3) for furnishing and erecting two 1400-gal. per minute centrifugal pumps and two 30-hp. motors, and two 2750-gal. per minute centrifugal pumps and two 50-hp. motors. Plans and specifications are on file in the office of the city engineer, Great Falls, and at the office of Burns & McDonnell, engineers, Interstate Building, Kansas City, Mo.

HINSDALE, MONT.—The Hinsdale Special Water and Light Improvement District has been created by the Board of Valley County Commissioners. Bids, it is understood, will soon be called for construction of water-works system, including pumping plant, reservoir lines and water mains and, for an electric-light plant and distributing system.

SIDNEY, MONT.—The Jennison Light & Power Company of Fairview is planning to extend its transmission lines to Sidney to furnish electrical service here.

DENVER, COL.—The California Street Improvement Association contemplates the installation of 28 ornamental standards on California Street, between Fifteenth and Eighteenth Streets, at a cost of about $3,100. The erection of 60 standards on Champa Street between Fourteenth and Twentieth Streets is under consideration by the Champa Street Improvement Association. Both associations agree to install the lamps and standards, providing the city will assume the cost of maintenance.

Canada

EDMONDS, B. C.—The Western Canada Power Company has been granted permission by the City Council to erect transmission lines on the Cariboo Road.

ALMONTE, ONT.—The installation of hydroelectric power is under consideration by the Town Council. The cost is estimated at $18,000.

ORRILLA, ONT.—The Water, Light and Power Commission has decided to ask the Town Council for an appropriation of $110,000 for the purchase of machinery, etc. in connection with the new hydroelectric power plant at Swift Rapids. The commission has also authorized contracts to be placed with the Canadian General Electric Company for three electrical generating units of 1500-kva, each, at $81,000, and with the Boving Hydraulic & Engineering Company of Lindsay, Ont., for hydraulic machinery, three units, for $29,300.

OTTAWA, ONT.—Bids will be received by R. C. Desrochers, secretary of department of public works, Ottawa, until July 10 for 163,500 lb. of galvanized iron telegraph wire, delivered at Montreal, Que., or 128,500 lb. of same delivered at Kamloops, B. C., and 35,000 lb. delivered at Vancouver, B. C. Specifications may be obtained at the office of the general superintendent of the Government Telegraph Service, at the Department of Public Works, Ottawa, Ont.; also at the office of J. T. Phelan, superintendent of government telegraphs, Vancouver, B. C.

RENFREW, ONT.—A report has been submitted to the Town Council by Engineer Kribs of the Hydro-Electric Power Commission of Ontario relative to the development of power at the first and fourth chutes of the Bonnechere River for the town of Renfrew. At the first chute it is estimated that 1500 hp. could be developed at a cost of about $150,000, and 2000 hp. at the fourth chute, for $300,000. Both chutes are located within a few miles of Renfrew.

WINDSOR, ONT.—The Electrical Distribution Company has applied to the Dominion Government for permission to lay cables to Detroit, Mich., on the bed of the Detroit River. The company proposes to supply electricity generated at Niagara Falls in Detroit.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until July 14 for furnishing storage battery warehouse trucks, hydraulic valve, oiler spouts, pulleys, chain blocks, snatch blocks, etc. Blanks and general information relating to this circular (No. 1056) may be obtained from this office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

HILO, H. T.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 13 (extension of date from July 28) for installing lighting fixtures in the United States public buildings at Hilo. For further information address the supervising architect, Washington, D. C.

Directory of Electrical Associations

Printed in the First Issue of Each Month

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AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

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ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. O. Oschman, Oliver Iron & Steel Co., Pittsburgh, Pa. Annual convention, Chicago, Sept. 18-22.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, E. Brettell, Electric Supply Company, Ltd., Vancouver, B. C.

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CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

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ILLUMINATING ENGINEERING SOCIETY. Secretary. C. A. Littlefield, 15th St. and Irving Place, New York. Annual convention, Philadelphia, Sept. 18, 19 and 20.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

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INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, Baltimore, Aug. 22-25.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thomson, Jr., Des Moines, Iowa.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Thomas A. Wynne, Indianapolis, Ind.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

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KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Temporary secretary, E. A. Wright, Manhattan, Kan.

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MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

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NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, New York, July 18-22.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee. Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION Secretary-treasurer, E. A. Thiele, Roswell, N. M.

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NORTHWEST SECTION, N. E. L. A. Secretary, E. H. LaTourneau, 602 Electric Building, Portland, Ore. Annual convention, Seattle, Wash., September.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, July 18-21.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

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PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va. Annual meeting, Parkersburg, W. Va., July 13-15.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRIC LIGHT ASSOCIATION. Secretary, A. H. Savage, Dakota Light & Power Co., Flandreau, S. D.

SOUTHWESTERN SECTION, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Chas. W. Graham, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,187,500. SIGNALING DEVICE; M. Cerf, Jr., Louisville, Ky. App. filed Oct. 16, 1914. Direction indicating system for autos.

1,187,534. ELECTRIC CUT-OUT BOX; L. Kossoy, New York, N. Y. App. filed April 1, 1914. Lid retaining construction.

1,187,543. ELECTRIC WELDING MACHINE; T. E. Murray and H. R. Woodrow, New York, N. Y. App. filed March 8, 1916. For welding together half sections of sheet-metal wheel hubs.

1,187,500. TESTER FOR ELECTRIC WIRING SYSTEMS; G. B. Raymond, Danbury, Conn. App. filed Jan. 11, 1915. Headset for testing for breaks or ground.

1,187,555. PORTABLE ELECTRIC FLASHLIGHT; C. J. Sagebrecht, Brooklyn, N. Y. App. filed Jan. 22, 1914. Construction of insulating casing and switch.

1,187,565. ELECTRIC SWITCH FOR PORTABLE ELECTRIC LIGHTS; B. Tauber, New York, N. Y. App. filed Nov. 13, 1913. Slide construction.

1,187,574. PORTABLE ELECTRIC LIGHT; C. Wachtel, Brooklyn, N. Y. App. filed Dec. 9, 1914. Has a leather casing.

1,187,586. ELECTRIC RAILWAY SIGNAL AND APPERTAINING MECHANISM; D. C. White, Tyrone, Pa. App. filed Dec. 7, 1912. Block signaling.

1,187,625. TIMING OR CONTROLLING MECHANISM; R. S. Jacobsen, Chicago, Ill. App. filed March 14, 1913. Has fluid operable means.

1,187,630. ELECTRIC FURNACE; M. M. Kohn, New York, N. Y. App. filed May 5, 1914. Can vary heat or maintain same constant.

1,187,633. METHOD FOR PRODUCTION OF CYANOGEN COMPOUNDS; A. R. Linblad, Ludvika, Sweden. App. filed Nov. 17, 1914. Electrically heated charge fed on a slope.

1,187,634. AUTOMATIC EXCHANGE; G. W. Lorimer, administrator of J. H. Lorimer, deceased, Brantford, Ont., Canada. App. filed April 24, 1900. Simplifies by grouping substations (425 claims).

1,187,645. FLOAT CONTROLLED CIRCUIT BREAKER; A. Mosegard, Morgan Hill, Cal. App. filed April 26, 1915. Stops engine when water becomes too low.

1,187,657. ATTACHMENT PLUG; H. R. Sargent, Schenectady, N. Y. App. filed July 14, 1915. Detachable construction.

1,187,670. JUMP-SPARK TESTER; P. B. Spofford, Haverhill, Mass. App. filed Feb. 13, 1914. Compact arms for application to spark plug.

1,187,671. AUTOMATIC TELEPHONE SYSTEM; A. E. Stevens, Quincy, Mass. App. filed Oct. 31, 1913. Primarily designed for use in private installation.

1,187,672. ILLUMINATING EYE SHIELD; J. Stiefvater, Utica, N. Y. App. filed Jan. 22, 1916. Eye shield supports a miniature lamp.

1,187,723. ADAPTER FOR ELECTRIC SOCKETS; J. H. George, Bridgeport, Conn. App. filed Oct. 15, 1913. For adapting lamps of two wire systems to a one-wire system and vice versa.

1,187,757. ELECTRIC HEATER; C. P. Madsen, Chicago, Ill. App. filed Dec. 26, 1911. Constructed to be used for a variety of purposes.

1,187,767. ELECTRIC ALARM; W. C. Neahr, Denver, Col. App. filed Nov. 27, 1914. Novel circuit controlling device.

1,187,768. ELECTRIC RELAY; W. C. Neahr, Denver, Col. App. filed Feb. 3, 1915. Maintains a device in operation for a predetermined period.

1,187,782. TROLLEY POLE DEVICE WITH AUTOMATIC RELEASE AND FOLDING; C. E. and P. Pigache, Paris, France. App. filed Feb. 12, 1915. Collapsing pole-base construction.

1,187,784. ELECTRICALLY OPERATED TYPEWRITER; P. C. Rawls, Des Moines, Iowa. App. filed Oct. 17, 1911. Operates the same regardless of touch.

1,187,795. APPARATUS FOR CONVERTING HEAT ENERGY; C. Trettin, Berlin, Germany. App. filed Oct. 31, 1913. Utilizes steam energy to highest possible efficiency.

1,187,805. INDICATING DEVICE FOR VESSELS; J. H. Benson, Key West, Fla. App. filed Aug. 5, 1915. Controlled by reversing lever of engine.

1,187,806. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE SYSTEM; G. A. Betulander, Sodertorns Villastad, Sweden; N. G. Palmgren, London, England, and O. Grahn, Stockholm, Sweden. App. filed July 12, 1915. Impulse relay and controlling magnet operated by variations of current in loop circuit.

1,187,823. ALARM FOR INCUBATORS; O. Erikson, Indiahoma, Okla. App. filed May 17, 1915. Small, compact and readily adjusted.

Record of Electrical Patents

Notes on United States Patents issued June 20, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

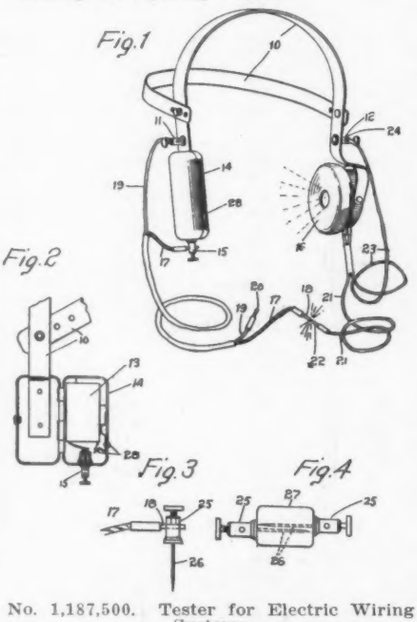
1,187,894. COMBINED CHOKE COIL AND FUSE; J. L. Fay, St. Louis, Mo. App. filed Oct. 19, 1914. Particularly for protection of transformers in distribution circuits.

1,187,839. CARBON HOLDER FOR ELECTRIC HEADLIGHTS; A. Hunsicker, El Reno, Okla. App. filed June 9, 1915. Insures complete consumption of each carbon.

1,187,872. SAFETY APPLIANCE FOR ELECTRIC RAILWAYS; J. C. Thompson, Lemoyne, Pa. App. filed Feb. 25, 1915. Derailing switch.

1,187,891. DIRECTION INDICATOR; W. Elmenthaler, Cleveland, Ohio. App. filed Sept. 10, 1914. For vehicles—has two independent sets of signals.

1,187,897. ELECTROMAGNETIC SWITCH; A. K. H. Friedemann, Chicago, Ill. App. filed Aug. 9, 1913. Remote-control, line closing and opening switch.



No. 1,187,500. Tester for Electric Wiring Systems

1,187,903. ELECTROLYTIC APPARATUS; W. E. Greenawalt, Denver, Col. App. filed June 30, 1913. Agitates electrolyte and retards disintegration of electrodes.

1,187,911. ELECTRIC SWITCH; B. D. Horton, Detroit, Mich., and W. P. Hammond, Passaic, N. J. App. filed March 24, 1914. Switch is open when cover is opened.

1,187,924. ELECTRIC WATER HEATER; C. O. Pearson, Brooklyn, N. Y. App. filed May 26, 1915. Controlled by a single valve.

1,187,928. TEST CIRCUITS; F. N. Reeves, Newark, N. J. App. filed March 2, 1915. Circuits or selector switch.

1,187,947. CALL-DISTRIBUTING SYSTEM FOR TELEPHONE EXCHANGES; A. H. Weiss, Wilmette, Ill. App. filed Nov. 4, 1911. Has operator controlled means to make cord circuit of any group receiving first incoming call.

1,187,982. FIRE ALARM; C. B. Eastman and M. C. Eastman, Georgetown, Mass. App. filed April 7, 1915. To show fire in any part of building.

1,187,985. TELEGRAPH TRANSMISSION SYSTEM; J. Gell, London, England. App. filed May 21, 1913. For bringing instruments into operation in proper sequence.

1,188,002. TELEPHONE SYSTEM; H. J. Meredith, Holyoke, Mass. App. filed Feb. 6, 1915. Uses alternating current for transmitting over great distance.

1,188,024. ELECTRICAL ATTACHMENT PLUG; C. E. Treat, Santa Ana, Cal. App. filed May 12, 1915. Spaced resilient jaws to receive different kinds of plugs.

1,188,045. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed March 4, 1912. Battery charging.

1,188,053. TELEPHONE APPARATUS; H. C. Egerton, Passaic, N. J. App. filed April 20, 1914. Microphone construction.

1,188,054. CONNECTOR FOR ELECTRIC CONDUCTORS; E. H. Faile, New York, N. Y. App. filed Sept. 16, 1914. For securing stranded conductor.

1,188,055. CONNECTOR FOR ELECTRIC CONDUCTORS; E. H. Faile, New York, N. Y. App. filed Sept. 16, 1914. Adapted to receive solder.

1,188,056. CONNECTOR FOR ELECTRIC CONDUCTORS; E. H. Faile, New York, N. Y. App. filed Sept. 16, 1914. Includes a wedge having solder incorporated therein.

1,188,057. PROCESS OF MAKING METALLIC FILAMENTS; K. Farkas, Glen Ridge, N. J. App. filed Dec. 13, 1910. Flexible to permit shaping.

1,188,060. FREIGHT-ROUTING APPARATUS; R. F. Fitzhenry and J. G. Ebner, Chicago, Ill. App. filed June 25, 1915. Overcomes misplacing of freight cars.

1,188,121. ILLUMINATING DEVICE; E. Weintraub, Lynn, Mass. App. filed Sept. 12, 1914. High-pressure mercury-arc lamp.

1,188,145. PHASE TRANSFORMATION; L. F. Blume, Pittsfield, Mass. App. filed Oct. 17, 1912. Two phase to three phase or vice versa.

1,188,148. HEAT TREATMENT OF RAILS; F. D. Carney and J. C. Reed, Steelton, Pa. App. filed Aug. 10, 1914. For hardening and toughening.

1,188,157. VIBRATING RECTIFIER; John T. Dempster, Schenectady, N. Y. App. filed Sept. 18, 1914. Uses flux in transformer to avoid necessity of extra circuit.

1,188,169. STARTING AND CONTROLING MECHANISM; R. D. Given, Crick, England. App. filed Aug. 3, 1914. For liquid rheostat.

1,188,182. INDUCTION MOTOR; F. H. Kierstead, Pittsfield, Mass. App. filed July 8, 1914. Squirrel-cage wiring with eddy current loss.

1,188,186. INCANDESCENT LAMP; I. Langmuir, Schenectady, N. Y. App. filed Dec. 20, 1913. Helical filament in inner gas.

1,188,194. GASEOUS CONDUCTOR LAMP; D. McF. Moore, E. Orange, N. J. App. filed May 7, 1914. Utilizes neon as a gaseous conductor.

1,188,196. INCANDESCENT LAMP; H. H. Needham, East Orange, N. J. App. filed Oct. 2, 1912. Tungsten lamp containing a constant fluorid.

1,188,202. HOISTING EQUIPMENT; C. L. Perry and M. A. Whiting, Schenectady, N. Y. App. filed March 5, 1915. Controls operation of two electric hoists.

1,188,220. ELECTRICAL DEVICE; E. Tamura, Sacramento, Cal. App. filed July 30, 1914. Bracket construction with branch outlet.

1,188,228. APPARATUS FOR ELECTROPLATING; F. S. Woodward, Richmond Hill, N. Y. App. filed April 3, 1916. Insures deposit on inner walls of deep pockets.

1,188,256. TROLLEY POLE; M. Dzwonka, Medina, N. Y. App. filed April 6, 1915. Spring mechanism and hold-down hooks.

1,188,272. BLOCK-SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed June 1, 1908. Rails conductively continuous for all currents.

1,188,273. BLOCK-SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed June 6, 1908. Uses two-coil relays.

1,188,295. CONTACT-BREAKER DEVICE FOR ELECTROMAGNETIC VIBRATING MEMBERS; A. H. Maitre and V. H. G. Martin, Rouen, France. App. filed Feb. 18, 1914. Brakes or damps the oscillation of the movable contact piece.

1,188,300. BURGLAR ALARM R. Millen, Birdville, Pa. App. filed April 27, 1915. Quickly applied to ordinary lock.

1,188,311. ELECTRICALLY ILLUMINATED FOUNTAIN PEN; H. Pendleton, Kokomo, Ind. App. filed Jan. 26, 1915. Miniature lamp disposed above pen point.

1,188,324. ELECTRIC SPARK-GAP APPARATUS; J. M. Roberts, Norfolk, Va. App. filed Nov. 4, 1914. Mingles flow of air with spark to get cooling effect.

1,188,350. SYNCHRONIZING DEVICE; W. B. Jackson, Chicago, Ill. App. filed May 19, 1913. Mechanical contact mechanism.

1,188,359. CHANGEABLE CONTROLLER FOR ELECTRIC SIGNS; S. Held, Chicago, Ill. App. filed Sept. 25, 1914. Gets different effects without disconnecting or rearranging the wires.

14,152 (Reissue). 994,510 (Original, June 6, 1911). ELECTRIC CAR LIGHTING SYSTEM; H. Grob, Furstenwalde, Germany. App. filed Aug. 27, 1912. Pressure regulating method with additional devices.